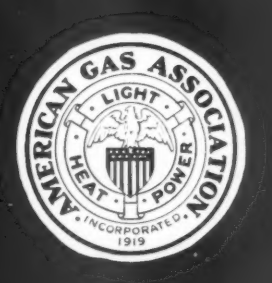
DECEMBER · 1936



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This Service, published in loose-leaf form, contains over 500 pages of complete and accurate information relative to gas rate schedules throughout the country. The volume is kept up-to-date at all times by supplementary sheets issued at frequent intervals, incorporating changes in gas rates as they occur.

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1. Complete gas rate schedules in effect for practically every community in the United States and its Possessions, Canada and Newfoundland, together with data on kind and heating value of gas supplied.

2. Complete list of gas companies with names of communities supplied by each company.

3. List of gas companies having special rates for water heating.

4. List of gas companies having special rates for house heating.

5. A tabulation showing all communities in which therm rates are now in effect and the names of companies serving these communities.

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THE TEST TUBE OF THE
GAS INDUSTRY
A G A
CENTRALLY LOCATED • EXCELLENT FACILITIES • MODERN EQUIPMENT • EXPERT STAFF
A RECORD OF ELEVEN YEARS OF SERVICE THAT SPEAKS VOLUMES
Cleveland
Los Angeles
TESTING
RESEARCH
19 37
Starting its 12th Year of Service To The American Gas Industry and To The Public

A. G. A. Testing Laboratories' exhibit at the annual convention

AMERICAN GAS
ASSOCIATION
MONTHLY

James M. Beall, Editor

On the Advertising Front

BY the time this appears, representatives of gas companies situated in all sections of the country will have attended a series of regional meetings at which a complete story of the Association's National Advertising Program was presented. Several months ago when preparations were made for inaugurating the program, the Committee to Conduct National Advertising, headed by Major T. J. Strickler, of Kansas City, planned the series of meetings that have just been held. It was definitely decided then that as soon as the program got well under way representatives of various geographical sections serving on the main committee would sponsor these regional meetings. On the Monday following the recent A. G. A. Convention at Atlantic City, Major Strickler met with representatives of McCann-Erickson, Inc. of New York and meetings, extending from coast to coast, were tentatively set up. Four days later, on November 6, Herman Russell, of Rochester, N. Y., president of the Association, issued the following letter:

"Perhaps the greatest single opportunity facing our business today is continued support of and effective local tie-in with the gas industry's national advertising program. From its inception Major Strickler and his associates on the Committee to Conduct National Advertising have carried the story of this campaign to you by means of bulletins. Their next step is to meet with you personally to obtain your ideas, criticisms and suggestions, to bring you a step-by-step analysis of the program and its objectives and to demonstrate with sound-slide film and other visual material how your company can profitably identify itself with the national drive.

"Your regional representative on the committee will shortly invite you to attend a meeting at a convenient location, and to bring with you to this meeting your advertising manager, sales manager, home service representative, manager of industrial gas sales and all others in your organization who should have a first-hand and intimate knowledge of the national advertising program and its possibilities.

"I am depending on you to give your regional representative the fullest measure of your support. I am confident that once you and your department heads hear the story in its entirety at the meeting soon to be called, you will see benefits in this cooperative move for additional sales that never occurred to you before."

Six days following the mailing of the above letter the first meeting got under way. In the eastern section meetings were held at Rochester, N. Y., New York City, New Haven, Boston, Philadelphia and Washington. In the central west, southwest and south, meetings were held in Columbus, Ohio, Pittsburgh, Kansas City, Detroit, Chicago, Dallas, Fort Worth, Houston, New Orleans, Atlanta and Memphis. Two additional meetings, to complete the schedule, are now being held, one at Seattle and the other at Los Angeles.

Reports forwarded to Major Strickler by members of his committee, who acted as chairman of the various meetings were optimistic as to the results secured. The attendance was uniformly good, a large amount of interest was manifested in the advertising that is being done, and representatives of gas companies gave detailed reports showing the various ways in which they are tying-in their local efforts with the

There's nothing like
GAS
for

BROILING
Gas gives you the intense heat needed to brown meats so fast that loss of juices is prevented. Full flavor is saved.

ROASTING
Gas gives you the oven ventilation which produces crisp, juicy roasts. Excess moisture is allowed to escape, preventing that flat "steamed" flavor.

BAKING
Baking requires an unlimited range of oven temperatures evenly distributed. That's why Gas assures light, evenly browned cakes, pies, breads.

FRYING
Perfect, speedy frying requires instant high heat—even spread of heat under the skillet—numberless heat variations. Gas gives them all!

BOILING
Faster! Gas brings foods to a boil in ⅔ or less the time of other fuels. Because it is more flexible, it gives you the exact degrees of heat you need.

national program or how they intend to do so now that they are familiar with the program, its scope and objectives.

The sound slide-film describing the program in detail was particularly well received. A number of companies have ordered the film and recording for use before meetings of their employees, dealers and others. In a number of cases companies held meetings of their department heads immediately following the regional advertising meetings, at which samples of the national advertising material were displayed and talks given on what the industry hopes to accomplish by carrying its story to the gas-using public. Another hoped-for result that was accomplished was the ordering of larger quantities of the tie-in material described in the portfolio.

Tie-in Material

Many requests were made for additional tie-in material, such as a complete plate and mat service of black and white advertisements for local newspaper use, calendars, blotters and home service leaflets. All of these suggestions will be brought to the attention of the Subcommittee on Approval of Domestic Gas Copy, headed by F. D. Cadwallader of Boston, at that committee's next meeting. Another portfolio containing this suggested new material will doubtless be put into production at a very early date.

The only material offered in the portfolio which has not been ordered in quantities sufficient to assure economical production are the car cards and the posters. It seems that gas companies are not general users of these two forms of advertising. The suggested four-page folder describing the program and designed for distribution to employees has been used very widely, with good effect. The same is true of plates and mats reproducing certain parts of the national ads, the penny folders and the appliance price tags.

It was announced at the meetings that the committee could not make available four-color reprints of the national ads appearing in the women's magazines and the *Saturday Evening Post* unless orders for these reprints permit of a press run of 100,000 copies to guarantee a price of $8 per thousand reprints. This press run was secured for the first two ads, but demand for the reprints has fallen off to the point where additional orders must be forthcoming to make that service available.

It developed at some of the meetings that more names should be added to the mailing list at Headquarters to receive the tie-in portfolio and progress bulletins. Some 800 new names are being added to this list. The tie-in material prepared by the committee for use by local gas companies is offered to all companies, whether they are financially supporting the program or not. There is no margin of profit in the sale of this material. The volume of orders received determine the unit price.

A check-up of the meetings shows that sentiment within the gas industry is greatly improved as a result of the inauguration of the national advertising program. There is a better feeling on the part of both management and personnel as the program reaches its full stride for the first year. News of the program has been spread throughout other industries, as well as into financial and banking circles, with good effect.

Requests for the booklet "Controlled Cooking" are arriving at Association Headquarters at the rate of 800 a day. As of November 24 about 20,000 booklets had been mailed to readers of magazines in response to written requests. In addition to this circulation several companies have stocked booklets and are making their own distribution.

GAS INDUSTRY PLANS GREAT AD CAMPAIGN

COOKING METHODS TO BE DEMONSTRATED TO HOUSEWIVES.

A $1,500,000 national advertising campaign to show American housewives better methods of cooking through modern gas equipment was presented to Dallas merchants and gas company representatives here Friday at a meeting in the Lone Star Gas Building. L. B. Denning, who recently retired as president of the American Gas Association, explained to the merchants that the gas industry through this advertising campaign was creating a tremendous interest in modern gas appliances and that they could cash in on this market by tying in locally with their own advertising.

Mr. Denning stressed the idea that prosperity has returned and that people are beginning to spend money for more home comforts. Recognizing this, the gas industry of the United States, after lagging behind for a time, he declared, has developed both its gas supply and its gas appliances to the point where a complete, efficient and economical service can be rendered. He urged the merchants to take advantage of this greatly stimulated interest in gas equipment.

Dr. Denning introduced John F. Scheetz of the McCann-Erickson Advertising Agency, New York, which is handling the advertising campaign for the American Gas Association. Mr. Scheetz's detailed presentation of the campaign showed that the color pages alone now being used in national magazines in this program, if laid end to end, would reach two thirds of the way around the world at the equator, and if stacked into the air would be seven times as high as the great Empire State Building in New York. These national magazines, he said, have a circulation in this territory of almost 5,000,000. He declared the next step in the plan is to have gas companies and merchants tie in locally with newspaper advertising in order to bring the message directly to the homes of this territory.

Not only local gas appliance merchants but plumbers, architects, engineers, builders and others are being enlisted in the plan to assist customers to get maximum use from gas appliances and the most possible efficiency and comfort in their kitchens.

"Sixteen million homes in the United States now cook with gas," Mr. Denning said, "and the natural gas industry alone produces more than twice the heat energy that the electric industry now produces. Without efficient, modern appliances in which to use this superior fuel service, of course, natural gas would be virtually useless. but now both the supply of nautral gas and the appliances have been perfected to a point where a complete, economical and efficient service is at the hand of every householder."

The highly developed news instinct of the Lone Star organization resulted in the above publicity which appeared in Dallas newspapers

Mystery Chef Radio Program Goes into Second Year

THE directors of Regional Advertisers, Inc., by unanimous vote, have decided to continue the Mystery Chef radio program for another year starting December 1, 1936 and ending November 27, 1937, for a total of 104 broadcasts over the split red network of the National Broadcasting Company. Eastern stations to be used are identical with those now in use, namely:

WEAF, New York; WNAC, Boston; WTIC, Hartford; WJAR, Providence; WGY, Schenectady; WBEN, Buffalo; WTAG, Worcester; WCSH, Portland; KYW, Philadelphia; WFBR, Baltimore; WRC, Washington; WHAM, Rochester; WSYR, Syracuse.

Eight companies on the Pacific Coast have also joined the Eastern companies in continuing the program, using the facilities of the following stations:

KDYL, Salt Lake City; KFI, Los Angeles; KGW, Portland; KOMO, Seattle; KHQ, Spokane.

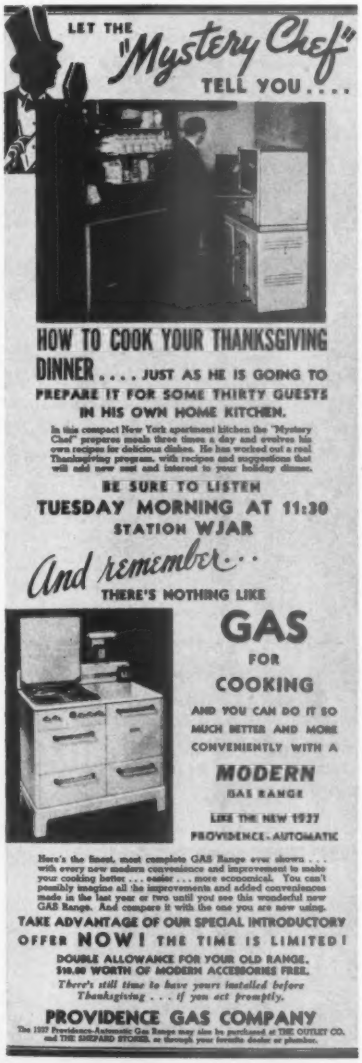
The program will be broadcast over the Eastern stations, with the exception of Rochester and Syracuse, which use transcriptions, at 11:30—11:45 A.M. New York time, Tuesdays and Saturdays. Pacific Coast companies will receive the program as rebroadcast from NBC studios in New York by transcontinental telephone at 1:00—1:15 P.M. New York time on Tuesdays and Saturdays (10:00 to 10:15 A.M. Pacific time and 11:00 to 11:15 A.M. Mountain time).

Contracts for a second year's continuation of the program call for participation of Eastern companies having nearly 5,000,000 gas meters in operation and Pacific Coast companies having approximately 1,000,000 meters in operation. In addition, a number of companies will continue to use the program over their local stations by means of electrical transcriptions.

Demand for the recipe book "Be an Artist at the Gas Range" has reached such proportions that a large reserve supply of books held at the printers at Buffalo, New York, has been completely exhausted. As of November 24 more than 1,000,000 books have been moved from the printers to participating companies on order. The directors of Regional Advertisers have authorized an additional printing of 500,000 books and these are expected to come from the presses at the rate of 50,000 copies a day starting December 9.

Although the program for the coming year will not differ fundamentally from that presently broadcast, there will be a closer tie-in with the themes emphasized in the national advertising program. Also, more material of a commercial nature will be introduced, particularly in reference to the latest improvements found on gas ranges. In the new edition of the recipe book and in future scripts the waterless cooking method will be recommended along with the low water method used by the Chef.

A number of companies will resume the use of electrical transcriptions beginning in January.


LET THE "Mystery Chef" TELL YOU....
HOW TO COOK YOUR THANKSGIVING DINNER.... JUST AS HE IS GOING TO PREPARE IT FOR SOME THIRTY GUESTS IN HIS OWN HOME KITCHEN.
In this compact New York apartment kitchen the "Mystery Chef" prepares meals three times a day and evolves his own recipes for delicious dishes. He has worked out a real Thanksgiving program, with recipes and suggestions that will add new zest and interest to your holiday dinner.
BE SURE TO LISTEN
TUESDAY MORNING AT 11:30
STATION WJAR
And remember...
THERE'S NOTHING LIKE
GAS
FOR
COOKING
AND YOU CAN DO IT SO MUCH BETTER AND MORE CONVENIENTLY WITH A
MODERN
GAS RANGE
LIKE THE NEW 1937
PROVIDENCE-AUTOMATIC
Here's the finest, most complete GAS Range ever shown... with every new modern convenience and improvement to make your cooking better... easier... more economical. You can't possibly imagine all the improvements and added conveniences made in the last year or two until you see this wonderful new GAS Range. And compare it with the one you are now using.
TAKE ADVANTAGE OF OUR SPECIAL INTRODUCTORY OFFER NOW! THE TIME IS LIMITED!
DOUBLE ALLOWANCE FOR YOUR OLD RANGE.
$10.00 WORTH OF MODERN ACCESSORIES FREE.
There's still time to have yours installed before Thanksgiving... if you act promptly.
PROVIDENCE GAS COMPANY
The 1937 Providence-Automatic Gas Range may also be purchased at THE OUTLET CO. and THE SHEPARD STORES, or through your favorite dealer or plumber.

A dual tie-in with two national programs, in one advertisement

Movies Offer New Opportunities

Perhaps it's the thought of cooking dinner on the modern gas range beside her that causes Dolores Del Rio to smile at Richard Dix in this scene from the Columbia production, "Depths Below." This new production will soon be promoted by motion picture managers throughout the country and offers an excellent tie-in opportunity to local gas companies. A suggested tie-in is a window display showing a typical Hollywood kitchen and using blow-ups of the above and other stills from the motion picture. Get in touch with your local theatre manager to find out when "Depths Below" will appear and how you can cooperate to your mutual advantage

Economic Future of the Gas Industry

By ROBERT E. GINNA

Manager, Rate & Contract Dept., Rochester Gas & Electric Corp., Rochester, N. Y.

THIS paper is a sequel to two other other papers presented this year by officers of my company; namely, H. Russell, president and J. P. Haftenkamp, vice-president. Mr. Russell, before the A. G. A. Executive Conference this past Spring, presented a study showing the comparative rate of return for different elements of the domestic gas and electric load separately or combined based upon "pro rata" cost analyses and the "status quo" situation. It covered the company point of view. This Fall, before the Empire Gas & Electric Association Convention, Mr. Haftenkamp reversed the story and covered the problem from the customer's point of view in making a selection between gas and electric service.

Domestic Load Needs Attention

Realizing that the domestic gas load problem requires constant and vigorous attention, we have made further studies in the hope of throwing some additional light on the all-important subject of the economic future of the gas industry.

My remarks are for the most part applicable to the gas industry as a whole; but perhaps are more pertinent to the manufactured gas industry than to natural gas situations.

To almost everyone who is familiar with the gas utility business, it is a well-known fact that during the past few years most companies have been sliding down hill or just holding their own, particularly from the standpoint of net operating income as a per cent of fixed capital, and few companies have actually gone ahead. This is particularly true in the domestic end of the business.

I believe that each of us should critically examine the company or companies in which we are interested as gas men, in order to determine what the future holds. I believe that the first step in this critical analysis is to decide whether the particular gas property in question can be operated profitably or not. In this connection it is important that we have a correct understanding of all the various factors involved.

I am going to discuss those situations where there are now revenues in excess of operating expenses, or where there is hope that the condition of the company can be improved at least to a point where it will be a profitable enterprise, and these situations I believe represent by far the majority. Also, I would include those companies that may now be making a satisfactory return, but which I believe will not long continue to do so unless the company is progressive and makes every attempt to hold existing business and to obtain new business.

Combination Companies

Before going further, I would like to voice this thought; namely, that one of the obstacles or difficulties so far as the gas industry is concerned is that a considerable number if not the majority of the gas companies, are combination electric and gas companies, either directly or indirectly. In such cases, it will usually be found that those who are responsible for the management of the company have been brought up in the electric industry rather than the gas, and in many cases it will be found that those who are responsible for the company's policy are electrically minded rather than gas minded.

When new business comes up, whether it be in industrial heating or commercial or domestic uses, the first thought seems to be that it should be done by electricity if it can be done by electricity, almost regardless of how the cost to the customer or the cost to the company in rendering service compares between gas and electricity.

From now on I am going to confine my discussion to the domestic end of the business, as it is only confusing to attempt to cover all, and in any event I believe that the domestic field represents that in which the greatest opportunity lies. In confining myself to this, I am also going to exclude house heating, as it is not so easy to generalize in regard to this business, the same comments are not always applicable, and so much has been written and said on the subject by others.

Room for Expansion

The major gas appliances in the field that I am discussing are the range, refrigerator and water heater. Right here some may say that this is already the answer, as the electric field has so many more appliances for which the public desires service. It is true that there are more uses for electricity, but to my mind this is not the answer as to why the electric industry is expanding while the gas industry is at best standing still. It will be found in almost every instance that the electric companies which have developed the higher kilowatt-hour sales per customer have done so almost entirely through the sale of electric refrigeration, cooking and water heating, and these represent the kind of service that the gas company can best render. Each of the major gas appliances is, or at least should be, almost a necessity to the customer, and with such a comparatively low customer saturation in refrigeration and water heaters there is no need for other and new types of appliances. There is plenty of room for expansion in the present appliance field.

I am not an authority on sales psychology, but I should imagine that if you were to put the question to almost anyone as to whether price would control if they intended to make a purchase, and they were considering two items each being as attractive in appearance as the other, and each being equally satisfactory from the standpoint of doing the work desired, the answer would be that the cost would be the controlling factor. If this is true, then I ask the question: "Why are electric refrigerators, ranges and water heaters sold in such quantities in a field where gas is available, and where gas appli-

Delivered before eighteenth annual convention, American Gas Association, Atlantic, City, N. J., October 26-30, 1936.

TABLE I

COMPARISON OF GAS AND ELECTRIC SERVICE COSTS TO AVERAGE HOME IN VARIOUS MAJOR CITIES OF UNITED STATES

	Electric Service for Lighting and Small Appliances Gas Service for Cooking, Water Heating and Refrigeration		Electric Service for Lighting, Small Appliances, Cooking, Water Heating and Refrigeration	
Cities	*Month*	*Annual*	*Month*	*Annual*
A	$7.67	$ 92.04	$12.39	$148.68
B	8.98	157.76	14.15	169.80
C	7.86	94.32	12.25	147.00
D	7.08	84.96	10.60	127.20
E	3.28	39.36	17.65	211.80
F	6.83	81.96	9.43	113.16
G	6.64	79.68	16.90	202.80
H	6.27	75.24	10.05	120.60
I	7.51	90.12	9.55	114.60
J	8.48	101.76	11.13	133.56
K	3.95	47.40	12.15	145.80
L	4.08	48.96	9.13	109.56
M	4.61	55.32	10.15	121.80
N	7.98	95.76	8.08	96.96
O	9.40	112.80	8.93	107.16
P	5.51	66.12	13.83	165.96
Average of above	6.63	79.56	11.65	139.80

ances cost the customer no more and where his bills would be less if he used gas."

Gas Costs Less

The fact that the gas service beats the electric service from the standpoint of cost is not new, but despite this fact, electric service has been making inroads on the gas industry, particularly in the refrigeration field.

Various studies that have been made confirm the conclusion that each and every executive of a combination company should give a few minutes of serious consideration to the facts that when there are existing gas facilities available it is better, generally speaking, to promote gas refrigeration, cooking and water heating than electric, from the standpoint of both the company and the customer. From the customers' standpoint it is better for the following reasons:

1. Cost of appliance.
2. Cost of operation.
3. Reliability of service, convenience, etc.

From the company's standpoint it is better because there is as much or more net revenue to be obtained in the added load, and a much better chance of retaining the net revenue in the case of the gas service, than there is in the case of the electric service; and because the gas department usually needs net revenue more than the electric department. It is necessary for the company to make little, if any, added capital expenditures with the added gas load, whereas it will be necessary to make a substantial capital investment, eventually if not immediately, when electric refrigerators, ranges or water heaters are added.

I do not mean that a combination company should refuse to sell these electric appliances, but I do mean that they should concentrate more on gas appliances. It is not only a fact that the electric manufacturers are more active than the gas manufacturers in bringing their products to the attention of the public but also it is a fact that our own salesmen do the same thing. If we cannot change the situation so far as the manufacturers are concerned, we at least should be able to change the situation in the case of our own salesmen and new business activities.

Load Studies

In order to give a picture from the standpoint of making available a guide as to new business policies and activities for the future, we have recently made studies to show what various added loads in the case of domestic customers will mean in the way of added net income to the company. The following summarizes the results we have obtained, and is based on a hypothetical property. While we believe that this hypothetical property is more or less typical and we have set forth the various assumptions and conditions taken, it would be strange if this material exactly fitted your case. However, it should furnish you some ideas and we give you herewith a summary of the results.

In the following Table (III) the above assumed rate is applied to the relative thermal consumption values of the major domestic appliances. The new electric refrigerators indicate an increasing efficiency of operation and it may be felt that 50 kw.hr. per month is too high. If it is, then we are overstating the gross revenue and net income value of the electric refrigerator in this study and the comparison therefore would become more favorable to the gas refrigerator.

Cost of Service

1. COSTS—GENERAL. Assumed that for both electric and gas, added loads are for existing customers only and therefore, all so-called "Customer Costs" are disregarded.

2. COSTS—GAS. Due to the fact that the usual manufactured gas prop-

TABLE II

HYPOTHETICAL GAS & ELECTRIC COMPANY

Assumed Domestic Service Rates Based upon Rate Survey of Various Combination Electric and Manufactured Gas Companies

1. RATES

Residential Electric Rate	*Residential Gas Rate*
First 30 kw.hr. @ 6¢	First 1500 cu.ft. @ $1.20 per M
Next 50 kw.hr. @ 4¢	Next 1800 cu.ft. @ 1.00 per M
Next 125 kw.hr. @ 2¢	Over 3300 cu.ft. @ .80 per M
Over 205 kw.hr. @ 1.5¢	537 B.t.u. manufactured gas

erty is not expanding and has ample capacity for all present and future loads (except perhaps space heating with which we are not concerned herein) all costs are considered on an increment basis only. In the usual situation particularly so far as the domestic business is concerned, it will not be necessary to increase the payroll or to add investment in either plant or distribution facilities even if the company should add all of the domestic gas load it can reasonably hope for. The cost of furnishing added load is, therefore, taken as the increment production cost of gas, which is here assumed to be 25¢ per M.

3. COSTS—ELECTRIC. Due to the fact that the electric industry is expanding and that any added load which is strictly not "off-peak" will require increased facilities and investment eventually, if not immediately, we may disregard any excess capacity which now exists and it is assumed that the added loads considered herein will entail both added investment and added operating costs. The cost of serving added load is assumed to be 15% of $250 (added production and distribution investment) per kilowatt of added system load, plus 5 mills per kilowatt-hour (average production cost).

In the case of this hypothetical combination company it costs the customer less to do his cooking, refrigerating, and water heating by gas. Not only does the company have an added financing burden when electric appliances are added, but its net revenue is less with the electric appliances, except in the case of the electric refrigerator.

TABLE IV

RESULTS

ESTIMATED NET INCOME—MAJOR APPLIANCES

Gas Appliance (a)	*Added Investment*	*Gross Revenue*	*Net after Operating Expenses and Fixed Charges*
Refrigerator	None	$21.60	$16.20
Water Heater	None	26.88	18.48
Electric Appliances (b)			
Refrigerator	$ 22.50	24.00	17.62
Range	283.00	30.00	19.95 (Deficit)
Water Heater	250.00	63.00	4.50

(a) Range omitted as this study applies only to added loads for existing customers and assumes that customer has a range.
(b) Lighting and small appliances omitted as this study applies only to added loads for existing customers and assumes that customer has this service already.

Here the difference is not great, it could easily be overcome by a slight change in the rates. In any event, for the combination company it is much more important to promote gas refrigeration and add $16.20 of net to the gas department than to add (perhaps temporarily) $17.62 of net from the electric refrigerator to the electric department.

Electric Cooking Uneconomical

In this hypothetical company the electric range shows the very discouraging result of losing about $20 per year (after computing 15% fixed charges on all the added investment). If the added investment for each electric range were taken as only $133 per kilowatt of added system demand ($150 total added investment per range) the electric range would just pay its way.

In review, then,

To the straight gas companies I say,—Go after the whole works—don't miss a trick—bar no holds.

To the gas men of a combination company, I urge:

1. Become gas-minded, or put in gas-minded men.
2. Analyze your own situation.
3. Sell service. Remember the customer decides the cost and doesn't always take the cheapest. Make the most out of the fact that the cheaper is also the best where gas is concerned.
4. Remember, a $1 net to the gas department may ultimately be worth more than $2 of electric net to both the company and the customer.

To all of you, I say, the economic future of the gas industry is sound and its salvation is in your own hands. The gas industry has waked up—now let's get out of bed!

TABLE III

ESTIMATED ANNUAL GROSS REVENUE—MAJOR APPLIANCES

Gas Appliances	*Yearly Average*			*Demand*
	Cu.Ft.	*Rate*	*Gross Revenue*	
Range	18,000	$1.20	$21.60	*
Refrigerator	21,600	1.00	21.60	*
Water Heater	33,600	.80	26.88	*
Electric Appliance	*Kw.hr.*			*Watts*†
Lighting and small appliances	360	6¢	21.60	*
Refrigerator	600	4¢	24.00	90
Range	1500	2¢	30.00	1132
Water Heater‡	4200	1.5¢	63.00	1000

* Not needed, for reasons given in 1 and 2, below.
† Maximum coincident demand per customer.
‡ Since the gas water heating service is *continuous* and *unrestricted*, no figures have been made on off-peak electric service.

Another Overseas Visitor at A. G. A. Convention

IN the post-convention rush the November issue of the A. G. A. MONTHLY failed to include an account of the appearance on the general sessions program of J. H. Wilson, managing director of Messrs. George Wilson Gas Meters Ltd., Coventry, England, who brought the greetings of The Society of British Gas Industries to the convention.

Mr. Wilson made a special visit to Atlantic City to participate in the proceedings. Before leaving he expressed his thanks for the kindness and consideration shown him by everyone and stated that the American gas industry had every reason to be proud of the exhibition and the enthusiasm shown throughout the convention. He was particularly impressed by the large attendance and the wide representation.

Annual Contest Brings Improvement in Prone Pressure Application

By JAMES M. CONNOLLY

The Brooklyn Union Gas Co., Brooklyn, N. Y.

A GREAT increase of interest in artificial respiration has been shown by employees in every division of The Brooklyn Union Gas Company since the inauguration of the annual Prone Pressure Contest by the company. This interest has been accompanied by an even more important factor—greater ability on the part of employees in applying prone pressure.

The contest was inaugurated in 1935. Its success during that first year indicated that this annual competition would be a vital element during future years in encouraging improvement in the application of prone pressure. This belief has been substantiated this year by the contest which was concluded in September.

Contestants' Ability

As to the ability of the contestants the following letter of Capt. Charles B. Scully, director of the Life Saving Service for the American Red Cross in New York, gives evidence:

"I should like to take this opportunity to express my appreciation for the invitation to judge the resuscitation contest of The Brooklyn Union Gas Company.

"As I told you at the time of the contest I have never in all my years of experience with resuscitation contests witnessed such excellent work. It was difficult, indeed, to arrive at a basis for determining which was the best team. They were all so closely matched that it seemed almost impossible to select any one above the other. Your company is to be congratulated on such high standing of resuscitation training."

The Brooklyn Union contest consists of a series of elimination rounds, two semi-finals and a final round. There are 10 elimination rounds with one team being selected as the winner in each round. Five of these ten winners meet in one semi-final while the other five meet in the second semi-final. Two teams are selected from each semi-final to compete in the finals.

Medals are presented to the members of the three best teams. Gold medals go to the members of the first team, silver medals to the second place team and bronze medals to the men finishing third. There are three men on each team, two operators and a patient.

The nine medal winners are disbarred from competing in future contests. This is done in order to give all employees a better chance of winning a medal and thus to encourage greater interest in developing proficiency in artificial respiration. For these reasons members of the company's special service crews, whose regular duties involve resuscitation work, are barred from competing in any contest.

In addition to the medals the division or department whose team wins the Prone Pressure contest receives a bronze plaque. It retains possession of the plaque for one year. Permanent possession of the plaque will go to the division or department which has teams winning three of the annual contests.

Origin of Contest

The beginning of the idea of this annual contest in The Brooklyn Union Gas Company is interesting. An annual contest started in one of the divisions of the gas company—its Coke Oven plant. This intra-departmental competition was so successful that the company's Executive Committee on Safety and Sanitation decided, after studying it, to inaugurate a company-wide contest.

That practice begets proficiency was demonstrated when three teams from the Coke Oven plant won first, second and third places in the first prone pressure contest. The members of these teams had practiced and competed in their own contest for several years and had the proficiency that enabled them to supply prone pressure better than the other competitors.

The rules for the two contests already held were based on the instructions in the company's booklet, "Shop Safety." For each round of the contest spaces were laid out and numbered. Each team performed in its designated space. The teams were called on in turn by the contest conductor at the direction of the judges.

Operation

When a team was called its members proceeded to the starting line which was at a point properly marked. The two operators carried the victim on a stretcher to the designated demonstration place (a distance approximating 30 feet), placed a blanket on the ground, removed the patient from the stretcher to the ground and started applying prone pressure. Each team continued operating until the judges had opportunity to mark the team as to its merits. Then the contest conductor signaled the operators to cease and to carry the patient back to the starting line.

While this was going on the judges estimated the abilities of the competitors and marked them on a score sheet. Contestants had the opportunity of knowing what factors were considered in the judging and how many points were awarded for each. A typical contest sheet showing the judge's estimate of the competing teams is shown.

Before, and during the period of the contest, stories on it are carried in the company's weekly newspaper. These stories announce rules, schedules and results and endeavor to promote greater interest in prone pressure. After last year's contest was concluded a summary of the contest was published. This stressed the points of weakness in operators and showed how they could be overcome. This served a double purpose of education—first for those who had competed and sec-

	Points Given	Points Obtained A	B	C	D
1. Time and manner of start	20	15	17	18	16
2. Use of blankets, etc	20	18	16	17	18
3. Chest position, normal	20	20	18	18	18
4. Nose clear of elbow, etc	20	18	14	18	18
5. Position of knees	20	18	18	18	15
6. Stiffness of arms	20	16	17	18	18
7. Pressure area of hands	20	14	16	18	17
8. Position of hands on patient	20	14	16	18	18
9. Shoulders	20	15	15	16	14
10. Rate of pressure application	40	36	36	38	34
11. Rate of pressure release	20	18	18	18	18
12. Effort used by operator	20	18	18	19	18
13. Manner of team relief	100	75	80	90	85
14. Use of inhalants	20	18	18	18	18
15. Rubbing patient's limbs	20	18	18	18	18
Totals	400	328	335	360	343

ondly for those employees who had not competed.

Throughout both contests interest was keen in artificial respiration. Employees were allowed time off to watch the competition. This was done with a view to aiding them in their own application of prone pressure. There was also keen rivalry between the teams and interest ran high among the employees who were anxious to know which team won each round.

The second annual contest has been completed and The Brooklyn Union Gas Company is looking forward to the third one next summer. It is expected that the interest as well as the proficiency in prone pressure application will continue to increase throughout the company.

Gas Exhibit Adopts National Advertising Copy Theme

FOLLOWING up its successful promotion of a Model All-Gas Home, the Staten Island, N. Y., Chamber of Commerce staged the most successful event in its history—the annual Exposition of Progress at which all the local industries displayed their wares. The attendance shattered all previous records, a total of 110,700 visitors being registered during the eight days of the exhibit from October 16 to 24. This represents approximately two-thirds of the total population of Staten Island.

Home Given Away

"One important reason for this record-breaking attendance is the great attraction of the Model All-Gas Home which was awarded by the Staten Island Chamber of Commerce as a door prize" said C. A. Kennedy, sales manager of the New York & Richmond Gas Company and one of the main forces behind this successful effort. Photographs of the model home and two views of the exposition are shown on the next page.

Gas service and modern gas appliances dominated this exhibit. The New York & Richmond Gas Company and a group of eight cooperating manufacturers occupied 2,400 square feet of exhibit space. The decorative scheme tied in with the American Gas Association's national advertising program through the use of slogans and enlarged reproductions of local tie-in display material.

The theme of the display "There's Nothing Like Gas for Cooking, Water Heating, Refrigeration and House Heating" was convincingly demonstrated to every Staten Island resident by the complete and attractive exhibits of modern gas equipment for hotel and home shown by the New York & Richmond Gas Company in its large central booth and by the following manufacturers whose exhibits surrounded the gas company's display:—Standard Gas Equipment Corp., American Gas Products Corp., The Bryant Heater Company, American Stove Co., Cribben & Sexton Co., Whitehead Metal Products Co., John Wood Mfg. Co. and The Surface Combustion Corp.

A two-day cooking school was conducted by the New York & Richmond Gas Company as part of the program of Exposition attractions and was a great success under the direction of Mrs. Lois Shelton Ford. More than 1,250 women attended. A modern gas range was awarded as a special grand attendance prize with other valuable daily awards including the foods cooked.

Mr. Kennedy, in reporting results, exhibited a list of hundreds of prospects for gas appliances of every description including a most satisfactory number for house heating. Many sales have since been closed. Many additional gas consumers have had the merits of modern gas appliances demonstrated to them. The Model All-Gas Home promotion and its grand climax at this successful exposition has provided enough prospects to keep the salesmen of the New York & Richmond Gas Company busy from now to Christmas with every indication that it will be a Merry Christmas with emphasis on the "Merry."

Appliance sales of this company are running more than 35 per cent ahead of last year.

Ray Martin Appointed Art Director

Raymond M. Martin

RAYMOND M. MARTIN, who has been director of display for the Consolidated Edison Company of New York, Inc., was appointed art director on November 1, according to an announcement by Henry Obermeyer, assistant to the executive vice-president. Mr. Martin will retain supervision of all display and poster activities of the Consolidated and its affiliated electric, gas and steam companies, while his new duties will include art direction of all types of advertising.

Mr. Martin joined the Consolidated Gas Company in 1922, in the sales end of the business, and two years later was made director of display. Subsequently the display work of the Brooklyn Edison and Queens Electric companies was placed under his jurisdiction.

At present the Display Division turns out from 400 to 500 window displays a year, about fifty posters of all types, and has charge of about twelve major exhibits. The Division also supervises several cooperative gas exhibits sponsored by the Industrial Gas Section of the American Gas Association.

Mr. Martin's work is well known throughout the public utility and advertising businesses. Credit is given to him for evolving a method of displaying gas and electric appliances which has been widely copied. His work has won nearly one hundred prizes in various national contests sponsored by the Public Utilities Advertising Association, the International Association of Display Men and other groups. He was chairman of the window display committee of the American Gas Association for two years and only recently had charge of the Association's exhibit at the World Power Conference at Washington. Under Mr. Martin's supervision, the company's display studio has grown tremendously.

Two views of gas appliance exhibit at Staten Island Exposition of Progress. Note tie-in with A. G. A. national advertising program

Model all-gas home which was awarded as a door prize at the Exposition

The model home was flood-lighted at night with gas lamps

Left—Kitchen of the model home with its modern gas equipment. Right—A corner of the basement recreation room showing how gas brings new opportunities for cellar rehabilitation

Degree-Days Page Mr. Consumer*

By W. L. JONES

The St. Louis County Gas Co.,
Webster Groves, Mo.

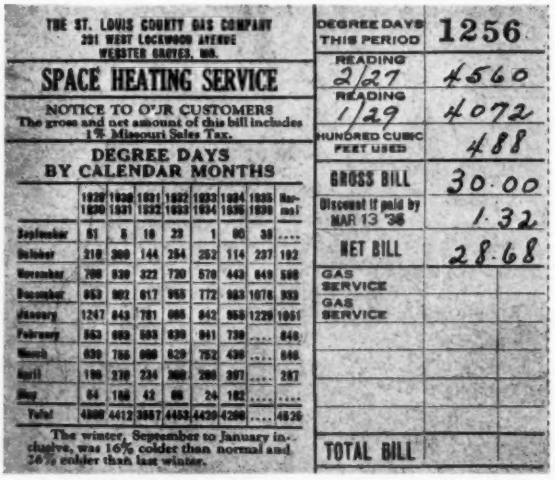
ENGINEERS familiar with heating calculations know that Degree-Days have been working for them for many years. It was more than ten years ago that this unit of measure was founded and since that time it has become widely accepted in practically all branches of the heating industry. Within the industry some would make changes in the unit and others suggest changes in the method of application but for the most part the Degree-Day unit serves its purpose and has done much to reduce the heating man's worry.

But have Degree-Days really been put to work? Ask the man on the street if he ever heard of one. When he has a home to heat he is vitally concerned. He will daily discuss how cold it is, how much fuel he is using, and similar related subjects. It is Mr. Consumer and not the engineer that today needs to know about Degree-Days.

Quick,—how soon can you give the answer to this problem? If the average daily temperature was 60 degrees F. every day during September and 45 degrees every day during November, how much colder, on a percentage basis, was November than September?

To most people the answer to this problem is obvious. . . . . November was 25% colder. But 25% is wrong. To the heating man who knows how to compare Degree-Days, November was 300% colder . . . . 600 Degree-Days as compared with 150.

But how can these matters be brought to public attention? Is Mr. Consumer interested? The answer can be well illustrated by one case wherein the public was let in on the secret of Degree-Days to the mutual advantage of all concerned. In 1932 The St. Louis County Gas Company made a large reduction in its gas heating rates and gave wide publicity to this fact. Several hundred heating customers were given definite information concerning the extent of the reduction and large numbers of new customers were given definite information concerning probable heating costs—assuming that the coming winter would be normal.



THE ST. LOUIS COUNTY GAS COMPANY
231 WEST LOCKWOOD AVENUE
WEBSTER GROVES, MO.

SPACE HEATING SERVICE

NOTICE TO O'JR CUSTOMERS
The gross and net amount of this bill includes 1% Missouri Sales Tax.

DEGREE DAYS BY CALENDAR MONTHS

	1930 1930	1930 1931	1931 1932	1932 1933	1933 1934	1934 1935	1935 1936	Normal
September	51	5	10	23	1	60	38	....
October	210	200	144	254	252	114	237	192
November	708	630	322	720	570	443	849	588
December	853	802	617	955	772	983	1076	933
January	1247	843	781	885	842	959	1229	1051
February	853	693	593	630	941	739	....	840
March	630	765	698	629	752	436	....	846
April	196	270	234	268	280	397	....	287
May	64	166	42	96	24	182	....	....
Total	4800	4412	3987	4453	4439	4260	....	4826

The winter, September to January inclusive, was 16% colder than normal and 24% colder than last winter.

DEGREE DAYS THIS PERIOD	1256
READING 2/27	4560
READING 1/29	4072
HUNDRED CUBIC FEET USED	488
GROSS BILL	30.00
Discount if paid by MAR 13 '36	1.32
NET BILL	28.68
GAS SERVICE	
GAS SERVICE	
TOTAL BILL	

The degree-days for the period covered by the bill are stamped on the bill. Note the table of degree-days for recent months for the cities served

Of course, no assurance could be given that the weather would be normal and so, before the winter set in, definite steps were taken to acquaint users with the heating term Degree-Days and its relationship to heating costs. If this could be done and the winter did vary materially from normal, customers would have a basis for understanding the variation.

First, arrangements were made with the United States Weather Bureau whereby temperature data were obtained daily. Following this, arrangements were made for each bill for gas heating service to show clearly, in a space provided for the purpose, the number of Degree-Days for the period covered by the bill. When these arrangements were completed a letter was sent to all heating customers explaining the Degree-Day unit and calling attention to the fact that the information would appear on their monthly bills for service.

Many of the customers who received this original letter have never actually learned the definition of a Degree-Day and it must be admitted that many who received the letter paid but little attention to it. However, from time to time other information on the same subject followed and the repeated entry of the Degree-Day information on monthly bills has kept the matter constantly before these people. During each winter various publicity measures have been used and today most gas heating customers know that the unit of measure of cold weather, in terms of heating requirements, is the Degree-Day. They do not know its technical definition, any more than they know the technical definition of an inch, but they do know that cold weather is measured in Degree-Days and that the gas company has up-to-date information on this subject.

Today in this community it makes little difference whether winters are normal or abnormal as long as heating cost variations show a reasonably constant relationship to Degree-Day variations. The winter of 1935-36 was 18% colder than normal and 24% colder than the preceding winter and yet, to people who heated with gas, the increase in fuel consumption was not shrouded by mystery and misunderstanding. These people had a measure of the weather. They used Degree-Days to gauge how much fuel they should use.

This case shows what can be done if

(Continued on page 436)

* This paper won third prize in Heating and Ventilating's recent Degree-Day Competition. Reprinted from September, 1936, Heating and Ventilating.

Natural Gas Reserves and Their Conservation

By DR. JOHN W. FINCH
Director, U. S. Bureau of Mines

Dr. Finch

ON two former occasions I have addressed the Natural Gas Department of your Association upon conservation of natural gas. This year officials of your Association suggested that I discuss natural-gas reserves. The two subjects are closely interrelated, because an inventory of gas still in the ground is essential in order to plan for the future.

I desire to meet the reasonable request of your officers that I talk upon reserves, but we have more accurate knowledge upon almost anything else relating to natural gas.

The Bureau of Mines has prepared no estimate of the Nation's underground gas reserves, but our extensive program of research on natural gas, much of it in cooperation with your Association, has included studies that might be utilized in estimating reserves. Our engineers have indeed computed proved reserves in several individual fields and areas; however, estimation of the total reserves of the Nation has not been undertaken, because our small technologic staff has been busy on things that seemed to command precedence. Figures upon gas reserves that I will submit are based largely on estimates that have been published or supplied to the Bureau through the courtesy of investigators who have been studying the subject.

Distinction between Proved and Prospective Reserves

Careful distinction should be made between the quantity of gas recoverable from *proved* reserves and the quantity that may be expected from areas and formations not yet thoroughly explored. Garfias and Whetsel have stated that "while estimates of *possible* and *probable* oil deposits are as a rule but idle conjectures, appraisals of *proven oil reserves* can undoubtedly be made with an ever-increasing degree of accuracy."[1] The same can be said of estimates of natural gas reserves.

Factors Influencing Future of Natural Gas

When gas reserves are discussed probably a majority of producers hope for figures showing great quantities and long life. People in such a group probably are disappointed because an outright statement in years can not be given. The future of the industry depends upon many factors besides the quantity of gas underground. The broad engineering, industrial, and economic view calls for careful analysis to avoid immature conclusions that might retard constructive thinking and action. We must consider not only the known quantity of gas in developed fields, and its economic availability, but also the probabilities and possibilities of discovering additional reserves, the effect of increased knowledge and improved technique in geology and geophysics, improvements in drilling and production practices making possible recovery of gas from deeper horizons, advances in conservation of natural gas not only in dry-gas fields but also in oil fields through decreased gas-oil ratios and better utilization of reservoir energy, possibilities of storing surplus gas in natural underground reservoirs, improvements in pipe-line transportation making practicable the delivery of gas from more remote sources, increased efficiency in use of gas, possibilities of mixtures of natural gas and gases from other sources, and many other factors.[2]

Estimation of Proved Gas Reserves

Reliable estimates of proved gas reserves in individual fields are essential to industrial organizations that finance the delivery of gas from such fields and to communities that depend upon the supply. Estimates of proved reserves for the whole country tell only part of the story, yet, properly interpreted, give some indication for the future. Unfortunately, however, such estimates are prone to reach the public through "scare headlines" announcing that consumers of natural gas will have to change their manner of living and doing business because on and after a certain date there will be no more of that efficient and convenient fuel.

Methods of estimating natural-gas reserves have been described in many publications.[3] I will not enter upon a technical discussion of that subject, except to say that proved physical laws enable the quantity of gas contained in a natural underground reservoir to be computed with considerable accuracy, if we have adequate data concerning the character of the reservoir and of the fluids within it. Given the volume of a gas-filled space underground, the pressure, temperature, and compressibility of the gas within it, relatively simple computations can determine the quantity of the gas. This is the "saturation" or "pore space" method of estimating "gas in place." Also, if we know the pressure, temperature, and compressibility of the gas in a natural underground reservoir at the beginning and end of a period of production, and know the quantity of gas produced during that period, we can compute the volume of the reservoir and the quantity of gas within it, provided we know that the volume of the reservoir has not changed, or how much it has changed.

Delivered before eighteenth annual convention, American Gas Association, Atlantic City, N. J., October 26-30, 1936.

This is the "pressure-volume" or "pressure-decline" method, which can be used satisfactorily only when there has been considerable production from a field. In many cases both methods can be applied, using one to check the other.

In using the "saturation" method the volume of the underground space is computed from well records and other pertinent data. The pressure and temperature of the gas in the formation may be measured with sub-surface gages or estimated closely from measurements made at the well heads. Laboratory tests can be used to determine the compressibility of the gas in cases where application of the laws of a perfect gas would result in considerable error.

Pressure-Volume Method

In using the "pressure-volume" method, the basic data are the quantity of gas produced, determined from meter records and estimates of unmeasured gas used or lost, the pressures and temperatures of the gas in the formation determined from measurements made at the wells, and data from well records indicating changes in the volume of the reservoir.

It is obvious that estimates can be made with increasing accuracy as the development and operation of a field progresses, if adequate records are maintained. Frequently an estimator finds that the operator has not realized the importance of obtaining or preserving needed information, and significant data are lacking and no longer obtainable.

The underlying principles of the two methods of estimating gas reserves have been used for years. Some of the early estimates, made before many of the present refinements were introduced, have been surprisingly reliable. For example, in 1915 when Petrolia field was about 40 per cent depleted, Shaw estimated that the gas originally contained in it was about 120 billion cubic feet.[4] Ten years later, when the field was nearing exhaustion, Sclater in a study for the Bureau of Mines found that about 115 billion cubic feet had been produced and about 17 billion cubic feet of recoverable gas remained in the sands.[5] Another example, in 1921 the Monroe field contained 65 gas wells, and was only about 2 per cent depleted. Bell and Cattell, of the Bureau of Mines, estimated 4¾ trillion cubic feet of gas, but did not assume that all of it would be recovered or available for consumption.[6] This field, now having more than 800 wells, has produced nearly 2 trillion cubic feet of gas and is likely to yield an equal volume in the future.

In general, however, an estimate made early in a gas field may not hold throughout its life. A careful engineer will include only the gas which he considers to be proved beyond reasonable doubt. As the field develops, more gas may be proved, and ultimate production exceed early estimates. In other cases, however, data may be insufficient or faulty and lead to overestimates. A calculation of gas reserves should, therefore, be preferably a "running inventory" of proved gas; the estimate should be revised from time to time as more or better data can be used.

Need for Study of Methods of Estimating Gas Reserves

Although the methods of estimating natural gas reserves are simple, their application may be complex. In applying the saturation method there may be uncertainties in determining the area of the structure, or the thickness and porosity of producing formations. In applying the "pressure-volume" method the effect of encroaching edge water in altering the shape and size of the gas-filled space may not be accurately determinable. When the gas is associated with oil, difficulties are increased by uncertainties concerning solubility of gas in the oil and its liberation from the liquid as the pressure is lowered.

In the early days of the industry, when investments were relatively small, rough estimates of gas were adequate, but now when gas is transported great distances to markets through pipe lines that represent enormous investments, sound business calls for careful study of the sources of supply, considering not only the quantity of gas but also the characteristics of the producing areas that affect the dependability of the supply over a period of years.

Although there are many recent refinements in estimation of gas reserves more study is needed upon characteristics of gas-reservoir rocks, liquid conditions in reservoirs, solubility of gas in and its release from liquids in the reservoir, producing characteristics of wells and changes with time, influence of well spacing on ultimate recovery, probable pressures in the reservoirs at the time of abandonment, compressibility of natural gases, adsorption of gases by reservoir rocks, and effects of vapors from water and other liquids in the reservoir. Secondary results of such a study would be: (1) to clarify the usage of such terms as "reserves," "proved," "recoverable" and "available" which now are applied loosely; (2) to emphasize the necessity of adequate records that could be used in calculating gas reserves, the kind of information needed, and the methods for taking and preserving data obtainable only at certain times in the life of a field.

Such a study has been discussed in connection with plans for cooperation between the Bureau of Mines and your Association. Investigations now in progress under the present cooperative arrangement are laying a foundation for that work, and I hope that before long conditions within the Bureau and the Association will permit a definite study of improved methods of estimating natural gas reserves.

Gas Fields of the Amarillo and Hugoton Districts

Time does not permit a review of the Nation's many gas-producing areas, but a discussion of gas reserves must include some mention of the Amarillo district of the Texas Panhandle and its neighbor, the Hugoton district of southwestern Kansas and the Oklahoma Panhandle.

The Texas Panhandle fields include about 1,400,000 acres, one quarter of which produces "sour" gas and the remainder "sweet" gas. In 1935, Cotner and Crum, in reporting on the Amarillo district, estimated an original reservoir content of 13.7 trillion cubic feet of gas in approximately 900,000 acres, where the average initial open flows of the wells are 10 million cubic feet per day or more, and 2.4 trillion cubic feet in areas where the wells are

smaller, giving a total estimated original reservoir content in the Texas Panhandle of 16.1 trillion cubic feet.[7] They reported withdrawals (including estimated wastage) of 3.9 trillion cubic feet to and including the year 1933.[8] The Bureau of Mines has not checked these estimates, but they seem worthy of mention to give an indication of the magnitude of the reserve in the Texas Panhandle fields. I might state that I was a member of a committee for the City of Denver that checked estimates of the life of the field before gas delivery was accepted by the city. The assumption was made that the gas would be conserved.

Wastage Stopped

This Amarillo district, which now is connected by pipe lines with Dallas, Fort Worth, Denver, Omaha, Kansas City, Minneapolis, St. Paul, Chicago, Detroit, and other cities, has received much adverse publicity because of waste of residue gas from gasoline plants. The situation in May, 1936, was discussed in a Bureau of Mines paper which called attention to past wastage of gas and the improvements in present practice. Constructive legislation upheld by court decisions has stopped the stripping of dry gas for its small gasoline content and wastage of the residue.

In recent months further progress has been made. Fortunately, the oil operators recognize the important role natural gas plays in the production of oil, and following elimination of waste in the gas area there has been a material reduction in gas-oil ratios in the oil-producing parts of the district. This in turn has encouraged use of gas from more of the oil wells for gasoline extraction, the residue from gasoline plants supplying fuel in the field or being burned for carbon black.

There is still some preventable waste of gas in the Panhandle, but gas operations there now appear better than the average in most other fields. Much credit is due the operators for constructive action.

The Hugoton area, north of the Texas Panhandle, is but partly developed, has not been drawn upon heavily, and has suffered no serious waste. In 1935, Cotner and Crum estimated the proved area to be 388,000 acres, the proved gas reserve 3.1 trillion cubic feet, and an indicated 678,000 acres additional probable gas-bearing area.[10] Some now consider the total of proved and semi-proved land, and land having possibilities, to be in excess of 2 million acres.

The Amarillo and Hugoton fields, considered as a unit, are, therefore, a vast reserve of natural gas. In spite of past waste in the Texas Panhandle, these fields are capable of supplying their connected markets for many years. However, the development and operation of such an immense acreage, 2 million acres proved and 2 million acres possible, involve the solution of legal and technical problems if the reserve is to be preserved. Unless these questions are solved satisfactorily waste will threaten again. The situation calls for the spirit of cooperation to conserve and insure efficient use of these enormous resources.

California Gas Fields

California is another area that may be touched upon briefly because of its importance, also because of the excellent data available through the work of Claude C. Brown, Chief Engineer of the California Railroad Commission.

Commercial production of natural gas in California commenced in 1901 in the Salt Lake field near Los Angeles, but California's natural gas industry, as we know it today, began in 1913 when a 12-inch line 110 miles long was laid from the Buena Vista Hills to Los Angeles. From that beginning, the industry has developed rapidly. Now about 1½ million consumers are served with natural gas. In 1935 California produced about 305 billion cubic feet of natural gas of which only 6.3 per cent was blown to the air. Between 1923 and 1930 from 60 per cent to 25 per cent was blown to the air.[11]

Although California has several "dry-gas" fields, most of the gas produced is casing-head gas, a by-product of oil operations. Bridge reports that from 1922 to 1934 California's dry-gas fields could furnish less than 10 per cent of peak requirements.[12] Casing-head gas production fluctuates with the production of crude oil, so the natural-gas industry exercises no direct control over the amount of such gas produced. Following discovery of new oil fields that for one reason or another cannot be developed in an orderly manner, production of gas often rises above market requirements, or above the capacity of existing outlets, and the surplus is blown to the air.

The decrease in natural gas wasted in California from about 60 per cent of the production in 1923 to 6.3 per cent in 1935, although due in considerable part to increased consumption and natural decline of flush oil fields, reflects more orderly development, improved methods of production, the growing realization that waste of reservoir energy reduces the ultimate recovery of oil, and the enforcement of State laws prohibiting production of oil with an unreasonable quantity of gas. California is making progress in conservation of natural gas, thereby enhancing the value of its large gas reserves.

Bridge pointed out recently that dry-gas reserves are necessary, where casing-head gas forms a large part of the supply, to take care of fluctuations in demand and in casing-head production, also to compensate natural decline in casing-head output.[13]

Dry-Gas Reserves

The dry-gas fields found recently at Tracy, Rio Vista, and McDonald Island, in the Delta district of the San Joaquin and Sacramento Rivers provide additional dry-gas reserves with high pressures and large well capacities, they have demonstrated the applicability of geophysical methods through which they were discovered, and they suggest the probability of discovery of other large dry-gas reserves in California. The recent new oil production southwest of Bakersfield may decrease the immediate need for the newly found dry-gas, but it does not decrease its importance from a long-range point of view.

The close association between oil production and gas production in California introduces large uncertainties into estimates of the State's gas reserves. Brown has said that recent estimates indicate California's reserves to be in excess of 18 trillion cubic feet, of which 11 trillion will be available for distribution.[14] Hoots and Herold take a less conservative view

and report a total of 34 trillion cubic feet.[15] It seems likely that the difference between these estimates may be due to interpretation of the word "reserve" rather than to differences of opinion concerning the potentialities of the California fields.

The Nation's Gas Reserves

It would be interesting to discuss the large gas reserves of the Gulf Coast, northeast Texas, northern Louisiana, and the Permian Basin of west Texas and southeast New Mexico, but time does not permit, so I shall pass on to a brief review of the national picture.

In the past a few areas have suffered at times from shortage of gas, but in general, in spite of the rapid growth of the industry, reserves have been found and proved in advance of urgent necessity for them. Discoveries apparently are keeping well abreast of production.

At your convention in October, 1931, the late President of your Association, Judge H. O. Caster, estimated that 13 gas fields and gas-producing areas in the United States contained reserves of 30 trillion cubic feet;[16] in discussing reserves of mineral fuels in the United States, Garfias estimated the proved natural-gas reserves at the end of 1934 to be 40 trillion cubic feet;[17] in a paper before this Association in May, 1925, Davis gave 62 trillion cubic feet as the result of his survey of the known natural-gas reserves of the United States;[18] and in November, 1934, Ley said:

> "Estimated future recoverable gas from commercially proved and important areas is not less than 75 trillion cubic feet, ... Most of this reserve has been discovered and proved in the search for petroleum, and some of this reserve will be wasted producing petroleum. Experience, expressed mathematically, proves that the chances of discovering gas are greater than the chances of discovering oil."[19]

Even considering that these estimates were made at different times, the range from 30 trillion to 75 trillion seems wide, but it is likely that the views of the men who made the estimates are not as divergent as the figures indicate. The differences may originate from varying uses and interpretations of words such as "reserves," "recoverable," "known," and "proved," as well as from differences in time and individual judgment.

Caster's estimates evidently were of proved recoverable reserves and did not purport to include all fields of the United States. Garfias states that his estimate of 40 trillion cubic feet "includes some 10 trillion cubic feet that will be wasted if production methods continue as at present and if the 'law of capture' is not superseded or intelligently modified." Davis' estimate is of "known natural gas reserves" and it is evident from his paper that he interprets "known" to have a somewhat broader meaning than "proved." Ley's estimate evidently gives large weight to gas that will be produced with oil and does not attempt to differentiate between gas that can be marketed and gas that will be lost.

Outlook for the Future

These estimates of "known" or "proved" natural gas, ranging from 30 to 75 trillion cubic feet, are from 16 to 40 times the 1⅞ trillion cubic feet produced and marketed in 1935,[20] but one should not assume from this that natural-gas operations in the United States will cease within the next 40 years. The frequency and magnitude of discoveries are as difficult to predict as trends in consumption, but it is certain that large reserves remain to be discovered and I am sure that few who have given the matter serious thought will disagree with Ley's statement, "There are no known geologic reasons why the recent high levels of natural gas production (metered) cannot be maintained for many years."[21]

Those of you who are in the natural-gas industry have interesting times ahead. The natural resource upon which your systems are based is limited, irreplaceable, and easily wasted. Fortunately, however, progress is being made in natural-gas conservation. The future will bring you many problems in adjustment of supply to demand, maintenance of adequate proved reserves, avoidance of over-development of fields, and prevention of waste, but it also will bring you the opportunity to serve a large population for a long period.

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DEGREE DAYS

(Continued from page 432)

the Degree-Day unit is taken out of its engineering cage and given to the public. The heating industry generally can benefit by following a carefully prepared program to acquaint the public with this unit of measure, a unit taught in few schools, although it concerns our every-day lives to a greater extent than many of the units that Mr. Consumer had to learn along with his "three R's."

Mass Output of Air Conditioning Units

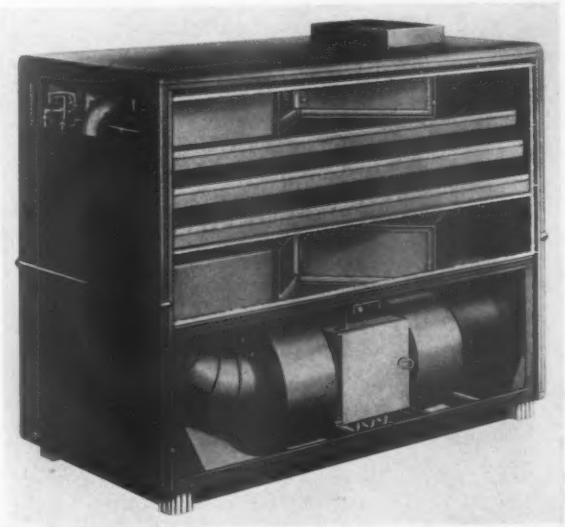
By J. B. NEALEY
American Gas Association

THE country has been gradually made "air conditioning" conscious and has now entered the second stage. This is the ability to differentiate between types, costs, and results. It has resulted in a decided swing to those units employing adsorption by gas heat energy for moisture elimination as against the freezing method. So far has this trend spread that the mass production of air conditioning units using gas is now an accomplished fact in at least one plant. This is the factory of The Bryant Heater Company, Cleveland, Ohio, for many years one of America's leading manufacturers of gas-fired house heating equipment, such as steam and water boilers, warm air furnaces, etc.

Recently, this concern equipped two assembly lines for summer air conditioners backed up with machines and equipment of sufficient capacity to keep these, and later others, operating. The sheet metal division, where the cabinets, silica gel trays, etc., are made, has a full complement of shears, brakes, etc., with the most modern of spot welders, suspended from overhead, for assembly. These assemblies are finished by spraying with paint and then baking the paint on in a battery of four gas-fired ovens. The parts are loaded onto trucks and wheeled into the ovens which are provided with automatic temperature controls and safety devices.

The main assembly line consists of a long, rolling platform type conveyor to which the sub-assemblies feed. This conveyor consist of parallel rails set on legs to bring the work to a height convenient to the workmen. Each assembly is made on a small car with casters which rolls along the tracks. Since the finished air conditioning unit comes off the line already packed for shipping, the bottom of the crate is the first item placed on the car. The steel frame of the unit is then bolted together and the motor and two squirrel cage fans placed within. Fans are built on a separate sub-assembly line. Next is added the motor which operates the dampers together with the damper assembly.

The silica gel bed chamber sub-assembly feeds onto the main assembly line at this point. The gas burners, together with the piping, are then put in and the control box, diaphragm valves, solenoid valves, automatic control equipment and pressure regulator are all added and the proper wiring installed. The unit is then boxed ready for shipment. The jacket and gel beds are boxed and shipped separately. Further expansion of this division is in sight and ample provision has been made for this. When it is remembered that gas entered the summer air conditioning field just two years ago, it can be seen that considerable progress has been made.



View of gas-fired air conditioning unit with front off

Gas summer air conditioning units in mass production. Silica gel beds and automatic control equipment being fixed in place

One of the final assembly lines. Motor and two squirrel cage fans being bolted to frame in foreground

Progress in Gas Rate Making*

THE gas industry in America, as well as in Europe, is entitled to look upon the electric industry as a kid brother for other reasons than the mere fact that it is twice as old. The electric industry has had its troubles, especially during recent years, but the gas industry has really been through the mill. It has done the impossible. It has come back, as the sports writers say, after some of the wise men were saying it was finished.

The come back in any field is as unusual as it is heroic. How many athletes, actors, politicians, have tried and failed? How many industries have ever done it at all? "They never come back," is the old refrain and a venerable assembly of departed business enterprises ranging from stagecoaches to snuff boxes bear mute witness to the truth of it.

Not so the gas industry.

Gas Comeback

First used almost entirely for domestic and street lighting, the gas industry was an established business with nearly a 100 per cent night load during the period when Thomas A. Edison and his assistants were baking thousands of odds and ends into carbon at Menlo Park, N. J., trying to perfect an electric light filament. By 1915, gas companies in the United States had largely relinquished their lighting load. But they were fighting for other fields and, as we all know, they came back with enormous success in cooking, industrial and home heating, and, more recently, refrigeration. Today the industry is bigger than ever before and the outlook is rosy.

Naturally such drastic shifts in operating practice required sharp transitions in rate technique and it was this interesting phase of the gas business that was the subject of a paper by Managing Director Alexander Forward of the American Gas Association, at the recent Third World Power Conference. He traced the development of gas rate making from the old-time charge per outlet, through the flat meter rate per thousand cubic feet, down to the more modern promotional rates, with due consideration to demand costs and fixed charges.

Mr. Forward pointed out two characteristics of the gas business that must be considered in modern rate making:

(1) *Utilities turn over capital only once in four years.*—The problem of utility managers differs from that presented to other business men in one notable respect. A manufacturer turns his capital over from 2 to 4 times a year and a merchant from 5 to 10 times. Utilities, on the other hand, turn their capital over once in three and one half to five years, and therefore require from $3.50 to $5 of capital for every dollar of gross annual income against the manufacturer's dollar per $2 to $4 of gross annual income and the merchant's dollar per $5 to $10 of gross annual income. Public utilities, therefore, must make careful studies of their valuations and costs in order to get, out of this comparatively limited gross income, a fair return upon the capital invested in utility property.

(2) *Gas business not a complete monopoly.*—In considering the problem of a fair return in the gas business, it must not be forgotten that the gas business today does not have a monopoly. Monopoly may be defined as such substantial control of a business or market as results in control over the price of the commodity or service.

There are very few services or commodities today that can long be maintained at high monopolistic prices in the face of competition from other commodities or services. In this respect the gas business has never enjoyed a monopoly. In the early days it had to compete with the candle, oil lamp, and electric light for lighting. Today it has to compete with the heating business with wood, coal, coke, oil, and electricity. This competition can be met only by rates of proper type and level.

Mr. Forward rehearsed for the benefit of the visiting delegates various standards of rate making which have been formulated by the regulatory commissions in this country—the allowance for operating expenses, adequate reserves for depreciation and contingencies, and reasonable return. Concerning capacity requirements, he stated:

A consideration of this question makes it evident that, before gas service can be established in a community, capital must be secured, that the amount of capital must be determined by the size or capacity of the plants to be constructed, and that the capacity of the plants must be determined by the requirements of the community. The capacity of the production plant is determined by estimating the probable maximum volume of gas that will be required in any one day. This is the total coincident maximum demand of all the customers for a day.

The capacity of the distribution system is determined by estimating the probably maximum volume of gas that will be required in any one hour. This is the total coincident maximum demand of all of the customers for an hour.

Since capital invested in production equipment is fixed by the total of the demands of all of the customers on the maximum day, it is evident that interest on the investment in the production plant is assignable to each customer in proportion to his individual maximum daily demand. Also, since part of the investment in the distribution system is fixed by the total of the demands of all of the customers in the maximum hour, it follows that interest on this part is assignable to each customer in proportion to his individual maximum hourly demand.

Mr. Forward went on to review principles of governing the allocation of costs involved in gas service which are doubtless familiar to readers of the *Fortnightly:* (1) Production demand costs; (2) distribution demand costs; (3) customer costs; (4) commodity costs. Finally, on the subject of rate fixing itself, Mr. Forward made this observation:

The establishment of actual rate schedules is distinctly a practical matter. The theoretical cost analysis which has been outlined should always be a guiding, though frequently not an absolutely controlling, factor. Public psychology and the prices of other competing services are given important consideration. In fact, with competition from electricity and other fuels becoming more and more keen, the value of service has gradually become a factor of at least equal importance to cost of service in gas rate making.

The effort to secure the maximum amount of business in the face of competition has led to the establishment of many rate schedules designed to meet specific conditions in a particular line of business. Thus there is today in the American gas industry an increasing use of class rates, limited to industrial or commercial business or to house heating, water heating, or refrigeration, or a combination of one or more of these with cooking. Due consideration is given to the local characteristics, diversity

* The material herewith presented has been taken in its entirety from "Public Utilities Fortnightly" for October 22. The "A. G. A. Monthly" is indebted to the editors for permission to reprint.

of use, and consumption per customer, all of which have a direct bearing on the cost of serving that class of service. However, the type and, within reasonable limits, the level of rate schedule necessary to attract the business are often the final controlling factors.

If the scientific or theoretically correct rate were applied to each customer's actual maximum hourly and daily demands, an amount of revenue greater than the necessary return would be received. This is due to the diversity of the demands of the customers; therefore it is necessary to apply a diversity factor to each customer's demands before the rate can be applied.

The *diversity factor* is the ratio of the noncoincident maximum demand of the customers to the coincident or actual maximum demand on the system. This applies to both hourly and daily demand. By noncoincident demand is meant the sum of the individual maximum demands of all of the customers, regardless of the time at which they occur. Coincident demand is the actual maximum demand made on the system. This factor is very difficult of determination, and yet its existence in the case of certain uses of gas, as well as its absence in certain other uses, is now recognized. One cannot think about the maximum demand on the distribution system made by a customer, without at once realizing that this demand will not coincide in point of time with the maximum demand of every other customer. . . . .

Diversity Factor

The great diversity among domestic customers is made evident by the very large volumes of gas that are demanded in the hours just before noon on Thanksgiving Day. In most communities it is the general custom to cook large dinners on that day and at practically the same hour. Consequently, there is a marked peak which does not occur on any other day of the year. The absence of any such peak demand on all other days indicates that on those days the time selected for cooking by individual customers varies over many hours of the day and over many days of the year.

It will be seen at once that the diversity factor must be determined if the effect of these diverse conditions of the use of gas shall be reflected in the cost factor.

Of course, consideration was also given to the fact that rates for gas are directly affected by near access to sources of supply of natural gas and to a lesser extent by access to long-distance transmission, and by-product purchases.

Along lines somewhat similar to Mr. Forward's paper was an article by W. J. Crowley and H. S. Jacobs, of the Public Service Company of Northern Illinois, recently published in *The Journal of Land & Public Utility Economics,* which attempted to analyze the practical marketing problems which face the gas industry in the domestic field. The article elaborated upon a comparatively little known subject—the consumption characterstics of domestic gas customers. Somewhat too technical in detail to review at length, this article by Messrs. Crowley and Jacobs concluded as follows:

. . . . some of the postulates which have been accepted for years in the gas industry must be revised in the light of newly revealed facts. In this survey alone the data obtained provide the basis for a distinctly new concept of the consumption characteristics of customers in the domestic group. Even if this information were not essential for the most effective solution of problems of immediate importance now facing the gas industry, it would still be of great value since it gives a truer understanding of the characteristics of the most important class of customers served by the gas industry.

Stated by itself this conclusion may seem rather vague but it does indicate that the technique of gas rate making is still in the state of flux and that the oldest of central utility services (after water service) is still alive to the necessity and desirability for constant improvement of rate fixing.

—E. S. B.

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Domestic Gas Consumption. By W. J. Crowley and H. S. Jacobs. "The Journal of Land & Public Utility Economics." May, 1936.

Gas Heating Gets a Boost

(Editorial from Public Utilities Fortnightly, October 22, 1936)

IT was during the recent sessions of the Third World Power Conference in Washington that ye editors had an opportunity to mix with some of the élite in the scientific world. Reflecting at length upon the perfectly obvious fact that Providence had bestowed upon us two ears but only one mouth, we endeavored to take the hint and listen at least twice as much as we spoke. Following this commendable practice we heard a number of edifying and instructive matters, but one conversation in particular would surely have interested and heartened our friends in the gas industry now gathering for their annual convention at Atlantic City, N. J.

By the same token, it would have left executives of the coal industry somewhat grumpy. If the coal men are peeved (as some of them seem to be) at the rate hydroelectric development is muscling in on their market, they would be downright enraged at the plans for fuel economy these mental heavyweights were talking over.

Well, it seems that on this particular evening there was an Englishman, a Swede, a Hollander, and an Irishman (don't be alarmed, we're not going to tell a funny story; they were really present in the flesh) comparing notes with some American engineers on fuel resources. (Ye editor lurked near-by disguised as a coffee table.) For some reason or other (maybe the cigars they sell in Washington hotels) the conversation drifted around to the smoke nusiance problem. The foreign visitors were estimating the annual cost of smoke damage in European cities: London, thirty million; Paris, twenty million; Berlin, twenty-five million, and all such figures. Of course, there is the Mellon Institute estimate for Pittsburgh's smoke bill at ten million which is pretty good for its size.

Then there was discussion of how about 70 per cent of the value of coal goes up the chimney when it is burned in the home. Well, what was the solution? The consensus seemed to be gas heating. In the interest of economy of fuel resources, public health, and aesthetic satisfaction, the learned men were inclined to the view that we are approaching the day when the use of coal for purposes other than raw material will have to be restricted or even forbidden.

Of course, we hasten to add (as we glance at a frowning picture of the beetle-browed John L. Lewis), all this was said to be a good while in the future. Nevertheless, we pass on the suggestion to the gas utilities for what it is worth. The Englishman said that he considered the development of gas heating just as important to public economy and health as the electrification of railroads. The Irishman and the Swede were bemoaning the lack of coal in their countries, while one of the Americans expanded with pride, not only about our own coal deposits, but about our natural gas and oil resources as well.

All of which indicates that America should be thankful that she has enough competing fuels to cause a problem, but it is still a problem for all of that.

What we must always bear in mind is the fact that our product—gas—is unquestionably, incontrovertibly the most efficient conversion of raw heat into heat energy in the world—CLIFFORD E. PAIGE.

Effects on Trees of an Illuminating Gas in the Soil[1]

By CARL G. DEUBER

Introduction

PROBLEMS concerned with trees injured by illuminating gas accidentally leaking into the soil may be said to have commenced in 1807 when the first public street gas lighting system was installed in Pall Mall, London *(10)*. Although various phases of the problems presented when illuminating gas is seeping into soil in which the roots of plants are growing have been investigated by botanists, chemists, and others for at least seventy years, no general agreement has been reached upon the exact manner in which vegetation is injured, killed, or otherwise influenced. A brief survey of the literature consulted is given to establish the present status of the general problem.

Tree Injuries

NEUMAN in 1842, according to GIRARDIN *(12)*, described the poisoning of elm trees by gas. By 1864, GIRARDIN, in Lille, France, was studying the soil for the cause of severe injury to Italian poplar trees located near a leaking gas conduit. About this time injuries to street trees were being reported from a number of European cities. The cause of the injury, and death of shade trees on several of the chief thoroughfares in Berlin brought about an extended controversy. This was described by LAISSUS and HEIM *(16)*. Some thought that gas in the soil was responsible; others thought that unfavorable conditions of water supply, nutrition, high temperatures, and other factors were chiefly responsible for the conditions of these trees. It was suggested that the soil around the roots of the trees should be inclosed by impervious cylindrical walls to avoid the action of illuminating gas, from leaking conduits, on the trees. In 1900, WEHMER *(25)* described the injury of elm trees in the vicinity of a gas leak in Hanover, Germany, and included an illustration showing the leafless condition of the tops of the trees and the sloughing off of large patches of the basal bark. In 1903 *(18)*, at Yonkers, New York, considerable trouble was experienced owing to gas injuries upon shade trees. The writings of STONE *(21, 22, 23, 24)*, from 1906 to 1916, gave evidence of the frequent instances of injuries to trees in New England which were attributed to the escape of illuminating gas in the soil. In recent years, in the United States field cases of gas in the soil affecting tree growth unfavorably have rarely been reported in the scientific literature. Accidental occurrences of this type are more frequent than is generally supposed. When they involve a conspicuous shade tree or extensive injury to a number of trees in a small locality the necessity for information upon the factors involved, accurate diagnosis, and possible remedial measures become urgent.

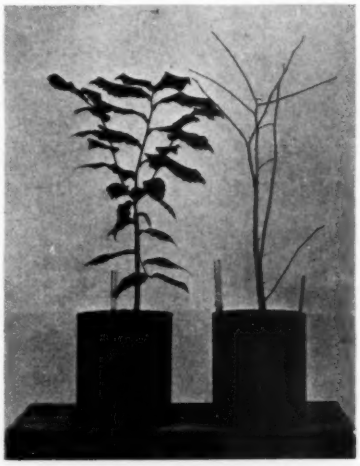

Figure 1. American elm trees in cans of soil with glass tubing reaching the bottom for the introduction of gas. Left, a tree before gassing. Right, a defoliated tree but with buds swelling along all the stems. Into the soil of this tree 864 cu.ft. of gas had been passed between July 28 and Aug. 3. Photograph taken Aug. 9

Investigative work with trees experimentally subjected to illuminating gas has covered a variety of the aspects of the general problem. LAISSUS and HEIM *(16)* describe one experiment by POSELGER in the 1860's, in Berlin, in which eight young trees planted in a wooden box were subjected to a flow of gas into the soil for three hours a day during forty days. No ill effects to the trees were observed and the conclusion was that gas in the soil was not injurious to trees. The toxic nature of the gas in Berlin was soon afterward established by KNY *(15)*, and SPÄTH and MEYER *(20)*. Differences in the susceptibility of various species of trees to injury by gas were noted by these investigators, and by WEHMER *(26)*, DOUBT *(7)*, and others. The toxicity of illuminating gas in the soil was attributed to residues of "brown oily substances" as well as high contents of sulphur and ammonium salts by GIRARDIN *(12)*. BOEHM *(1)* associated the injurious action of gas with the "tarry products" left in the soil. BRIZI *(2)*, EHRENBERG *(8)*, EHRENBERG and SCHULTZ *(9)*, SORAUER *(19)*, and SCHOLLENBERGER *(17)* considered the displacement of oxygen in the soil atmosphere the chief cause of injury to vegetation. HARVEY and ROSE *(13)* thought ethylene was the most harmful constituent remaining in the soil in a gaseous state. WEHMER *(27)* emphasized hydrocyanic acid as the chief toxic agent. HITCHCOCK, CROCKER, and ZIMMERMAN *(14)* found that while the removal of hydrocyanic acid greatly reduced the toxicity of one illuminating gas it did not eliminate the injurious effects of the gas in the soil. Detailed descriptions of the symptoms and the field conditions associated with shade trees injured in various ways were made by STONE *(21, 22, 23, 24)*. The writer *(3, 4, 5, 6)* reported injurious as well as stimulative phenomena which were observed when small trees

Reprinted from PLANT PHYSIOLOGY, *11*: 401-412, 1936.

[1] Contribution from the Osborn Botanical Laboratory, Yale University.

or tree parts were exposed to illuminating gas.

The accurate determination of injuries to established trees, directly attributable to gas in the soil, is attended with many difficulties. Three major factors involved in determining the cause of injuries are: the gas, the soil environment, and the tree. Each of these is complex and highly variable, and the diverse combinations that may and actually do result present many confusing field problems. *Frequently the symptoms of gas injury in a tree are distinguished with difficulty from those resulting from other unfavorable conditions for growth.** Conditions such as a hard packed surface soil, and coverings of impervious paving, which restrict aeration of the soil, make the solution of the problem more difficult. Illuminating gases are of different types depending on the process of manufacture. The composition of one gas may vary widely from time to time. Differences in the chemical composition of manufactured gases may account for the more severe action of gas leaks on vegetation in one community than in another. Gas from a modern manufactory is subjected to purification processes in the recovery of by-products and in the removal of ingredients known to have a corrosive action on metal pipes so that the constituents held chiefly responsible for the toxic action of gas in the soil during the past and from older manufacturing plants may not be those responsible for the effects of all illuminating gases. In an unpublished work the writer tells of three types of currently used manufactured gas. He here indicates that the epinastic response of tomato plant leaves varies with the respective gases when these gases surround the roots. The extent of a gas leak, the rate of flow of the gas, the quantity passing into the soil, and the time over which it acts are additional conditions of importance in determining the influence of illuminating gas on vegetation. It is with the latter features of rate and volume of gas flow that the present study is concerned. An attempt was made to establish for the gas used, and under the conditions imposed, quantitative limits for the amount of gas required to kill small trees when the illuminating gas was passed into the soil about their roots.

Experimentation

During the spring and summer of 1934 the following tests were made for the purpose of recording the influence of various rates of flow and quantities of a typical manufactured gas supplied to the soil in which three-year-old American elm trees were growing. The trees had been grown in clay pots and in April were transplanted to cans holding approximately 1 liter of soil. A layer of sand was placed on the bottom with a glass tube extending from the sand layer to beyond the rim of the cans for the introduction of the gas at the bottom of the soil and the root system. Upon a layer of loam soil the root mass of the potted trees was placed and additional soil sifted and tamped around the sides. Thirty trees were prepared in this manner and given regular greenhouse care.

Figure 2. The same elm tree on the right in Figure 1, twenty days later. Leaf and twig buds developed rapidly on this completely defoliated tree along all the stems except at the upper nodes. Considerable new stem growth was made before winter and normal foliage development and growth occurred the next year. Photograph taken Aug. 29

Gassing of the soil of the trees took place outside a ground level window with rubber and glass tubing reaching from a laboratory gas outlet through a wet meter or a calibrated flow-meter to the bottom of the soil in the cans. The gas was of the coke oven type as supplied by the New Haven Gas Light Company. For the period covered by this study the average composition of this gas, together with the percentage of each component, except for naphthalene which is recorded in grains per 100 cu.ft., is given as follows:[2]

Carbon dioxide	1.70
Illuminants	3.00
Oxygen	0.20
Carbon monoxide	8.70
Hydrogen	51.00
Methane	25.90
Nitrogen	10.00
Naphthalene	3.50
Sulphur	trace
Hydrocyanic acid[3]	——

Between May 2 and August 7, 1934, twenty of the elm trees were subjected to a gassing of the soil about their roots. Brief descriptions of ten of the trees during and following the gassing treatment are reported.† Later, additional data will be reported in regard to trees subjected to gas in the soil when the surface of the soil was covered with paraffin. Ten trees were grown through the summer as controls. Both the control and the gassed trees were placed in shallow trenches in the soil out-of-doors over winter so that the effects of the gas treatment upon the trees during the next season could be observed.

In addition to the foregoing tests, three elm trees in cans, prepared as previously described, were treated by passing 36, 14, and 7 cu.ft. of gas into the soil and immediately sealing the soil surface with a layer of melted paraffin. The surface of the soil of one control tree was similarly sealed and the control trees of the previous tests served as checks of the behavior of the trees in normal soil with a free surface. Within ten days after the treatment of the soil of one tree with 36 cu.ft. of gas the characteristic "ethylene effect" of leaf epinasty appeared. Epinasty was most evident in the lower leaves, and less evident in

* Italics ours—Editor.

† Descriptions contained in the original article have been omitted here due to space limitations —Editor.

[2] The writer is indebted to W. A. Fitzsimmons, Superintendent of Production of the New Haven Gas Light Company, for this analysis.

[3] The laboratory reports showed no hydrocyanic acid present.

the upper young leaves. Gradually the leaves of this tree became very dry and hard, the older leaves became brown from the margins to within 1 cm. of the midveins. The tree in soil receiving 14 cu.ft. of gas lost two-thirds of its leaves and exhibited marked chlorosis of the remaining leaves. The tree in soil through which 7 cu.ft. of gas had been passed continued normal in appearance except for a slight chlorosis at the bases of three leaves. The leaves of the control tree with the soil surface sealed became somewhat dry and hard. One month after the gas treatments these trees were removed from the cans for an examination of the roots. The soil was very dry and the small fibrous roots broke readily when the soil was being removed. Secondary roots had some areas of outer bark sloughing off. These features were common to the roots of the control tree with the soil surface sealed as well as of the gassed trees. During 1935 these trees made normal growth of tops and roots.

Discussion

The experimental results in this study in many respects follow the observed conditions and the known facts of a number of field cases of injury to established shade trees by illuminating gases leaking into the soil, which the writer has followed during the past six years. Rapid killing of a shade tree within a few days or a few weeks has been seen occasionally, but the more numerous cases are those in which chlorosis of the foliage on a portion of the tree and partial defoliation is subsequently followed by the drying out and death of uppermost twigs, and the dying of some branches and not of others. This process of gradual injury, although making for an unsightly tree and a hazard on streets because of the brittle branches likely to fall at any time, may continue for three or more years. The latter cases are the most confusing to diagnose, especially when the source of the gas in the soil is no longer evident and the tree is subject to serious insect and fungus attacks as a result of its lowered vitality, exposed branch stubs, loosened bark, and similar features associated with such trees.

With these young elm trees, two of the twenty were completely killed by the spring of the next season after the gassing. While some of the trees, those subjected to 5 and 10 cu.ft. of the coke oven gas, exhibited no signs of injury, those gassed with 32 to 864 cu.ft. of gas showed chlorosis of leaves, partial or complete defoliation, and the death of terminal parts of branches. In two instances, defoliation was soon followed by the development of latent buds on the stems, below the injured part. In the following season many instances of partially killed stems were observed but new shoots were also produced and made excellent growth. Complete recovery would be expected with these young trees, based on their behavior the season following the gassing. Complete recovery in a larger tree would not be expected because of its age and the loss of so many branches from its top, regardless of the formation of new shoots.

Experimental Conditions

Flowing 5 to 864 cu.ft., or 141.5 to 24,451 liters, of coke oven gas into one liter of soil for a period of twelve minutes to fifteen days was thought to embrace sufficiently drastic experimental conditions to produce rapid and definite lethal effects in these small elms. The results of the tests made it necessary to abandon the objective to determine even approximately the volume of this gas required to flow into the soil to kill these trees. Neither the conditions of the tests nor the physiological action of the toxic ingredient or ingredients permitted assigning definite values to the amount of this illuminating gas to produce unmistakable lethal effects in a short period of time. A review of the experience of others in experimentally subjecting trees to illuminating gases in the soil will add to the interest in the explanations offered for the results of this investigation.

KNY *(15)* supplied illuminating gas at the rate of 418.5 cu.ft. per day through four burners in the soil at the base of a twenty-year-old maple tree. The gas flowed from early July to January and involved an enormous volume of gas. A neighboring *Evonymus* bush showed withering of leaves and defoliation early in September; a nearby elm tree exhibited signs of injury; while the maple defoliated early in the fall. The following spring the bush and the two trees were dead. Into the soil beneath a linden tree 380 cu.ft. of gas were passed daily. This tree, although severely injured, was able to produce small pale leaves the next spring. SPÄTH and MEYER *(20)* found that 25 cu.ft. of gas per day, in July, killed the roots of established trees in a few days, but in the winter when the roots were dormant the trees were much more resistant to injury by twice this rate of gas flow. SHONNARD *(18)* found that 1.07 cu.ft. of gas per hour added to the soil of a potted lemon tree caused chlorosis of the leaves in five days and defoliation in eight days. EHRENBERG and SCHULTZ *(9)* subjected two-year-old linden trees to rates of gas flow into the soil of 0.2 to 2.7 liters per hour for a month. Partial defoliation was the chief feature noted, and when the trees were transplanted to fresh soil they recovered.

Chicago Tests

Work at the University of Chicago constituted a major contribution in the United States upon the plant physiological effects of illuminating gas. HARVEY and ROSE *(13)* recorded a variety of experiments with seedlings and potted plants exposed to ethylene-air mixtures, and to illuminating gas. High concentration of illuminating gas brought about rapid killing of the roots, and the chief symptom was death. This same gas flowing slowly through the soil in which woody plants were growing brought about a stimulation of the roots which resulted in the development of new tissue. When "water gas" of the Chicago Gas Light and Coke Company was distributed at the rate of 1.5 liters per hour in the soil beneath an *Ailanthus* tree on the campus from July 3 to September 2, leaves of some of the younger shoots wilted in eleven days. Subsequently, these and a few more leaves shriveled and died but no general effect over the entire tree was observed until early defoliation occurred in September. In October, the tree was dead and was characterized by a general dryness of the tissues. DOUBT *(7)* demonstrated the sensitivity of the tomato plant and other plants to low concentration of ethylene and illuminating gas in the atmosphere, and tested the responses of small potted

trees to gas passed into the soil. With eight trees of different species treated forty to ninety days with 60 to 180 liters of gas in the soil, the foliage was little changed by the treatments. Swelling of the basal portion of the stems, cracking of the bark, and the production of proliferation tissue on underground parts were frequent symptoms. The most severe injury was exhibited by an American elm tree subjected to 180 liters of gas during ninety days. This tree lost half of its leaves, the bark at the base of the stem cracked open, and at the conclusion of the treatment the underground parts were dead. The conclusion was reached that the killing of trees by illuminating gas is a very slow process which may take months or years.

Response Classified

Previous studies by the writer *(3, 4, 5)*, in which woody plants and their parts were subjected to a "mixed" illuminating gas, and in some instances to ethylene led him to conclude that there were three classes of plant physiological response to this illuminating gas: First, stimulation, such as acceleration of early development of latent buds, epinastic growth of leaf petioles, hypertrophy of lenticels, and proliferation of root parenchyma cells. Second, injury, such as inhibition of bud development (particularly terminal buds), dwarfing of leaves, loss of rigor by leaves, chlorosis, drying of portions or of entire leaves. Third, killing effects, which differ primarily in degree from those of injury. They were made evident in dormant trees by a blackening and drying out of buds without any sign of normal development, drying and wrinkling of the bark, drying out and brittleness of the stem and root wood, and when rapid, no hypertrophy of root lenticels or proliferation of parenchyma cells of the root. The type and the degree of the physiological response of these small trees varied with the time of exposure to the gas, the volume of the gas, the condition of the tree (dormant or growing), and the organ or part of the tree exposed to the gas.

HITCHCOCK, CROCKER, and ZIMMERMAN *(14)* found that when gas of the Westchester Lighting Company was introduced into the soil of small potted willow, maple, cherry, and silver bell trees at volumes of 1 and 4 cu.ft. for a period of thirty minutes, the larger volume caused the greater injury. Four cubic feet of the gas brought about severe injury to the roots with no ill effects on the aerial parts except in willow and maple. All of the woody plants, including privet, recovered in three to four weeks after the gassing with 4 cu.ft. of this gas. Ten cubic feet of this gas killed the five species of woody plants.

Lethal Effects

While the literature regarding the experience of other workers, who subjected trees to illuminating gases in the soil, does not permit concise generalization, it is evident that in most of these studies rapid lethal effects were not reported. Relatively large volumes of gas were required to seep into the soil for a considerable period of time before the death of entire trees occurred. Leaf, stem, bud, and root injuries frequently occurred, and, if the gas flow was of sufficient magnitude and continued long enough, death of the entire tree resulted. Injury to tops and roots in a number of cases was followed by recovery. A possible exception may be seen in the work of HITCHCOCK *et al. (14)* in which lethal effects on woody plants were observed when 10 cu.ft. of the Westchester Lighting Company gas was passed into the soil of small potted trees. The highly toxic nature of this gas was ascribed to the presence of hydrocyanic acid. When this acid was removed from the illuminating gas, twenty to twenty-four times more gas was required to produce the same type and degree of injury induced by the unscrubbed gas. Removing hydrocyanic acid, however, did not make this gas non-toxic.

Since the coke oven gas used in the present study was freed of hydrocyanic acid by an efficient scrubbing process at the manufactory it is logical to seek the explanation for the effects produced in the elm trees in the action of other constituents.

Experiments performed at this laboratory in which a "mixed" illuminating gas as well as ethylene and air mixtures were used, led the writer to conclude that it is possible to ascribe the responses of the elm trees gassed in the soil with coke oven gas to ethylene, or compounds with a similar physiological action on woody plants. In the complex composition of a commercial illuminating gas there may be a number of ingredients which will affect woody plants as ethylene does. The earliest symptoms of controlled soil-gassing in the elm trees were chlorosis and defoliation. Unpublished work done at this laboratory with ethylene in concentrations of 1 to 50 per cent in air held about the bases of rooted cuttings of privet or the washed roots of small oak trees caused chlorosis, defoliation, and the drying out of the tops of woody plants. It is concluded therefore that ethylene, or gaseous ingredients of similar physiological action on plants, can explain the symptoms observed when relatively large volumes of the coke oven gas employed in this investigation are passed into the soil in which small elm trees are growing.

Summary

1. This investigation is concerned with a description of the symptoms observed when relatively large volumes of a coke oven type of illuminating gas were flowed into the soil in which young elm trees were growing, and with the probable explanation of these symptoms.

2. Five or ten cubic feet of this coke oven gas applied to the roots of elm trees produced no visible signs of injury.

3. When 32 to 864 cu.ft. of gas were used, a variety of injurious symptoms were observed in the trees. Chlorosis and defoliation were the chief early symptoms, followed, in some cases, by the drying out of the apical portions of the stems. Roots sustained injury but the sequence of this injury and its extent were not determined with these trees in undisturbed soil. Epinasty of leaves was observed following gassing when the soil surface was sealed with paraffin. The stimulation of lower buds into active development was observed on stems defoliated by gas passed into the soil about the roots.

4. Two of the twenty trees that were gassed died before the beginning of the next growing season.

(Continued on page 450)

Brooklyn Union Honors Employees at Annual Service Emblem Dinner

EIGHT employees of The Brooklyn Union Gas Company were presented McCarter Medals and nine others awarded McCarter Certificates at the twelfth annual Service Emblem dinner of the company, held on November 5 at the Columbus Club, Brooklyn, N. Y. The 17 McCarter winners were among the approximately 300 employees given emblems, medals and awards at the dinner.

Service emblems, denoting 25 or more years of faithful service, were awarded to 231 employees. This is the largest group of emblem recipients in the 12 years the emblem dinners have been held. Of the 231 emblems 118 went to employees who during the past year completed 25 years of service. Sixty emblems went to 30-year employees; 28 to 35-year men; nine to 40-year men; eleven to 45-year men; two to 50-year men, and three to 55-year men.

At the present time there is a total of 744 employees on the company's service honor roll, comprising employees who have served for 25 years or more. The man with the oldest service is Michael J. Shay, who has 61 years of service to his credit. The grouping of the others follows:

7 employees with service of between 55-59 yr.
9 employees with service of between 50-54 yr.
36 employees with service of between 45-49 yr.
53 employees with service of between 40-44 yr.
86 employees with service of between 35-39 yr.
174 employees with service of between 30-34 yr.
378 employees with service of between 25-29 yr.

McCarter Medals

The eight employees who won McCarter Medals are Joseph Casey, Thomas V. Clancy, George Heinsohn, William J. McAdams, David Nolan, Edward J. O'Donnell, Owen Vahey and Charles H. Wildhagen. Mr. O'Donnell's medal was awarded posthumously, this winner having died since his heroic act. The medal was presented to his widow, Mrs. Margaret O'Donnell.

McCarter Certificates were presented to Patrick Boylan, Thomas Butterly, Patrick Costello, Charles Cottam, John Dowd, Henry Herbst, Thomas F. Neary, Harry Oelerich and Patrick Ward.

In addition to the 17 McCarter winners two employees received the President's Medal of the National Safety Council for their efforts in saving life. These two are Dennis Nainor and Louis J. Beissel.

Brooklyn Union employees have won the following awards:

Name of Award	*No. of Employees*
McCarter Medals	102
McCarter Certificates	50
McCarter Medal Bars	7
President's Medal, National Safety Council	6
President's Certificate, National Safety Council	4

Twenty-seven men were presented the Brooklyn Union's special award in recognition of their services in a variety of fields. Four employees, who, in other ways, saved lives or prevented injuries, were presented the company's special awards. Two others, who, though unsuccessful, had made valiant attempts to save life, also received special awards.

Special Awards

The company presented special awards to an employee who had designed a much-needed tool, to a man who had developed a more efficient technique, and to 14 meter readers who had avoided errors throughout last year, although each read in excess of 20,000 meters. Special awards also went to five chauffeurs, each of whom had driven for five years without an accident.

Miscellaneous other awards were made at the dinner. The Holder Division team consisting of Harold C. McCabe, Robert Newell and John E. Smith, which won the 1936 Prone Pressure Contest, was presented the handsome bronze plaque and each man received a medal.

Albert Stampe, president of The Brooklyn Union Gas Club, awarded the trophies and medals to teams and individuals who had distinguished themselves in baseball and bowling during the past year.

Charles C. Atwood, assistant chief engineer, presided at the dinner. He introduced President Clifford E. Paige, who addressed the diners and presented the service emblems to those men who had completed 35, 40, 45, 50 and 55 years of service. The emblems for the 25- and 30-year men were awarded by Vice-Presidents B. G. Neilson and F. Christopher Weber.

Mr. Weber also awarded the McCarter Medals, McCarter Certificates, National Safety Council President's Medals and the Brooklyn Union's Prone Pressure Plaque and medals. Mr. Neilson presented the company's special awards and its Achievement Trophy.

Tribute was paid to the veteran employees by President Clifford E. Paige who delivered the only address of the evening. Mr. Paige also discussed various phases of the company's business, showing how it has met conditions during the past year and how it is preparing for the future.

In his address he called attention to the fact that approximately 16% of the company's employees have served for 25 years or longer. He related some of the outstanding achievements of employees, showing the capability of the individuals and of the company.

In talking about the company's business and its future prospects Mr. Paige called attention to the large increase this year in sales of gas-using appliances. The increase is the greatest in the company's history, he said, and is especially noticeable in the domestic field where sales of house heating equipment have shown the greatest rise.

While appliance sales have increased tremendously, Mr. Paige told his audience that sales of gas from these appliances have not yet been fully realized. Substantial increases in gas sales are expected with the coming of colder weather when the automatic gas heating equipment will be used.

British Executive Dies

J. C. WALKER, general secretary of the British Commercial Gas Association, died November 5 following an operation. Mr. Walker was well known to the gas industry in this country as a result of friendly relations over a long period of years.

Born in 1888, Mr. Walker joined the staff of The Gas Light and Coke Company in 1902, being appointed to the personal staff of the then chief inspector, F. W. Goodenough, later and better known as Sir Francis, controller of gas sales. In 1912 he joined the staff of the newly formed B.C.G.A. For 25 years Mr. Walker served the B.C.G.A. without sparing himself, becoming in turn assistant secretary, 1912, secretary, 1920, and general secretary, 1932.

Memory of Arthur Hewitt Honored

A VACANT chair, draped with purple and black satin ribbons, was placed at the head table at the opening banquet of the Toronto board of trade meeting last month in honor of the memory of the late Arthur Hewitt, who was honorary chairman of the club from 1930 until his death. A replica of the club's official gavel is being presented to the Hewitt family with an inscribed parchment bearing the resolution of sympathy passed at the meeting.

Employees of The Brooklyn Union Gas Company who were awarded McCarter Medals or Certificates for acts performed during the year. Left to right, top row—Patrick Ward, Charles Cottam, Patrick Boylan, Owen Vahey. Second row—Thomas Neary, David Nolan, Thomas B. Clancy, Patrick Costello. Third row—Charles Wildhagen, Thomas Butterly, Edward J. O'Donnell, John Dowd. Bottom row—Harry Oelerich, William McAdams, George Heinsohn, Joseph Casey, Harry Herbst

Safety Training Again Comes To Rescue in Emergency

By W. REED MORRIS
Vice-President, Koppers Co., Seaboard Division

HOW safe the job has been made, how safe the home has been made, how widespread the benefits of safety education as conducted by America's great industrial organizations may be matters of pure speculation. It is patent, however, that the training given to millions upon millions of employees by industry has been carried to every corner of the country. Hardly a day passes that some result of such education does not evidence itself in the day's news.

We have recently seen a striking example of this within our own industrial family. William W. Dobbing, 33, employed in the coal handling department of our coke plant at Kearny, New Jersey, revived a young woman struck by lightning and believed to be dead, by applying the Schafer prone pressure method of resuscitation. During the three years of his employment with the company, Mr. Dobbing voluntarily attended the first aid classes conducted as a matter of plant routine by E. C. Riplinger, our safety engineer.

I recently had the pleasure of presenting to this employee the President's Medal of the National Safety Council, and the certificate which accompanies it. During a thunderstorm Mr. Dobbing and party of six were breaking camp, following a vacation at Tupper Lake, New York. Miss Priscilla Martin, a member of the party, left the others to lock the door of a near-by cabin. The bolt struck, tearing her clothes, scorching her shoes, burning her in the body and head. As breathing had stopped, she was believed to be dead, but Dobbing applied artificial respiration, learned in the course of his industrial experience. One hour later the young lady was breathing normally. By that time, the nearest physician had been summoned by speed boat from a town seven miles distant to take charge of the patient.

The cost of maintaining comprehensive safety programs is great, judged by cold dollar volume alone. But it is insignificant indeed when scaled against the tremendous benefits which have accrued as a result of such expenditures. Benefits which have well served industry, and which have spread out from every safe practice plant in ever enlarging circles to extra-industrial activities. I believe that today, as a result of the widespread adoption of safety training and safety practices, there is not a village, even remotely located, which has not been touched by its effect.

William W. Dobbing, right, receiving the President's Medal of the National Safety Council from W. Reed Morris

Book Review

Lighting by Gas, An Outline of Its History.—Dean Chandler, of the South Metropolitan Gas Company, London, has prepared "a general survey of the evolution and progress of gas lighting from the time when gas was first used as a substitute for oil and candles."

The work is profusely illustrated with interesting drawings and photographs which indicate to the student of gas industry history that Mr. Chandler has searched widely for material in the original; there is no evidence of errors having been carried forward, so frequently the case in presenting data which have not been taken directly from the archives. To those who have occasion to make similar studies, and necessarily peruse valuable old books and other publications, many in private libraries, the present compilation should prove a welcome time-saver.

From the earliest lighting experiments, and including historical material on production, together with a section on the meter, the author has faithfully conducted his readers through the long and interesting story of the open flame gas light to the very latest domestic and street lighting in which the company with which he is associated has so successfully pioneered.

—A. G. K.

John F. Egolf Dies

JOHN F. EGOLF, vice-president of Western United Gas and Electric Company, Aurora, Illinois, died suddenly November 22 of a heart attack. He was 63 years old. He had been general manager of the electric interurban lines in the Chicago area since 1922. He was a member of the American Gas Association.

F. H. A. Offers Water Heater Sales Plan

THE Federal Housing Administration has recently produced a sixty-day sales program on gas water heaters, applicable for financing under F. H. A. modernization loans.

The program is designed to increase the sale of gas water heaters by gas companies and their cooperating appliance dealers. Information is given on other gas equipment eligible for F. H. A. financing.

The portfolio describing the program includes suggestions on merchandising helps, direct mail, radio, advertising and publicity. A complete schedule for putting the sixty-day campaign into effect is given.

Six McCarter Medals Awarded

Henry A. Kerbe, gas fitter of the Consolidated Gas Electric Light and Power Company of Baltimore, Md., receiving a McCarter Medal from Herbert A. Wagner, president of the company

AT an employee association event held on the evening of October 3, with approximately 1500 persons in attendance, Herbert A. Wagner, president, Consolidated Gas Electric Light and Power Company, Baltimore, presented a McCarter Medal to Henry A. Kerbe, gas fitter of the company. Mr. Kerbe had performed an outstanding act of life saving by use of the Schafer prone pressure method of resuscitation.

In making the presentation, Mr. Wagner gave a brief description of Mr. Kerbe's quick action in reviving a woman who had been overcome by gas. Mr. Wagner then stated that Mr. Kerbe had received the congratulations of his supervisors and commendation of the management for the efficient manner in which he conducted himself.

This presentation is the third McCarter Medal to be awarded an employee of the Baltimore company.

Four employees of the Consolidated Edison Company of New York were singularly honored at a departmental meeting November 6 in the office of N. T. Sellman, assistant vice-president. The following three received McCarter Medals and Certificates for having performed successful resuscitations by the Schafer prone pressure method: August Henry May, Frank James Euler, and Harry H. Burghardt. The fourth employee, John E. Borges, received a McCarter Certificate for assistance in a resuscitation.

At a special staff meeting, Conrad N. Lauer, president of The Philadelphia Gas Works Company, presented McCarter Medals and Certificates to Joseph C. Smith and Frank A. Ritchie, employees in the customers' service department and the controller's department, respectively. Both employees received this outstanding honor for acts of resuscitation performed by the Schafer prone pressure method. Their quick action and thorough knowledge of effective resuscitation methods averted tragic loss of life.

New Jersey Gas Association Holds Regional Meetings

OVER 2,500 gas men and women attended the regional meetings of the New Jersey Gas Association held at Asbury Park, Newark, Hackensack, Vineland and Camden on different evenings during November. A program that was instructive and entertaining was offered those attending from 10 gas company and 45 manufacturing company members. In addition, an opportunity was given those in attendance to renew old and make new acquaintances.

William Walsh, of the Elizabethtown Consolidated Gas Company, discussed the flexibility of gas for cooking, pointing out that the user of a modern gas range does not need to adapt her cooking preferences to the requirements of a range. The gas range is adaptable to any type or method of cooking. He advocated strongly the use of time control as a means of bringing greater convenience and modernization to the kitchen.

A playlet entitled "Work for the Salesman, and He Will Work for You" portrayed a typical sale of a gas water heater on an evening call. The purpose of the sketch was twofold: first to outline a suitable selling method for salesmen; and second to show non-selling employees the effort that is put back of leads they turn in. The cast of three persons included Mr. and Mrs. Pierce, prospective purchasers of water heating service by gas, and Mr. Stewart, gas company salesman. Separate groups presented the playlet at the different meetings.

The second annual prize paper contest was announced at the meeting, the subject of the paper being "How Can I Help My Department Contribute Most to My Company in 1937?" Last year's contest attracted over 75 papers.

W. S. Potter, treasurer of the Elizabethtown Consolidated Gas Company, and president of the New Jersey Gas Association, spoke briefly before all meetings.

Australian Bulletin Now Printed

DEMAND for the Bulletin of The National Gas Association of Australia reached such proportions that it was necessary to put out the third issue in printed form. The October issue of the Bulletin, in its new dress, is an attractively prepared magazine filled with newsy stories concerning the wide awake Australian gas industry. It is a welcome addition to the periodicals received by the American Gas Association.

Convention Calendar

DECEMBER

7-8 **National Industrial Council—National Association of Manufacturers**
Waldorf Hotel, New York, N. Y.

9-10 **National Association of Manufacturers**
Waldorf Hotel, New York, N. Y.

1937

JANUARY

25-27 **American Society of Heating & Ventilating Engineers**
Hotel Statler, St. Louis, Mo.

25-29 **American Institute of Electrical Engineers**
New York, N. Y.

FEBRUARY

10-12 **Southern Gas Association—Southwest Regional Gas Sales Conference**
Peabody Hotel, Memphis, Tenn.

10-12 **New England Gas Association**
Hotel Statler, Boston, Mass.

MARCH

Wisconsin Utilities Association—Gas Section

MAY

4-5-6 **Pennsylvania Gas Association**
Lodge of the Sky Top Club, Sky Top, Pa.

Wk. 10 **Natural Gas Department, A. G. A.**
Kansas City, Mo.

JUNE

10-11 **Canadian Gas Association**
Chateau Laurier Hotel, Ottawa, Canada

24-26 **American Society of Heating and Ventilating Engineers**
New Ocean House, Swampscott, Mass.

Accounting Section

Herbert E. Cliff, Chairman H. W. Hartman, Secretary E. J. Tucker, Vice-Chairman

Rotation and Transfer of Employees

By E. A. NICOL

The Philadelphia Gas Works Company, Philadelphia, Pa.

THE systematic transfer of employees from one position to another within a department or between departments, when justified, is being recognized more and more as a wise and profitable policy of personnel management.

The justification for a regular transfer routine may develop mainly from a desire to attain two objectives; first, it may be a move toward ideal departmental flexibility; and, secondly, it may arise from a desire to place the employee in the position most satisfactory to himself and most advantageous to the company.

Rotation of Employees

There can be no doubt that the rotation of employees to obtain flexibility, when feasible, carries with it many advantages which may be equally as desirable as the main objective. For not only does a systematic plan of rotation develop a group of employees familiar with several jobs and available for immediate use when absences occur, but it provides also a valuable incentive with resultant employee interest and lessened labor turnover. Ultimately such a plan builds up a group of potential supervisors who, through practical experience, are conversant with company policy and practice and are able to interpret intelligently both the employer and the employee point of view. To the employee is presented a greater opportunity to learn, to use his ability, and to provide a basis for increasing his earning power. In turn, the public receives a service rendered by an employee equipped to apply himself confidently and thoroughly to solution of its problems.

But before embarking on a theoretically ideal rotation program, careful consideration should be given to some of the difficulties attendant to its administration. Obviously it is impossible to effect a complete inter-departmental rotation. It has been found, however, that there can be arranged such inter-changes as the rotation of laborers between Production, Construction, and Distribution Departments, with the resultant advantages of eliminating to some extent seasonal lay-offs and achieving greater regularity of employment. Inter-departmental rotation also furnishes an ideal training program for those definitely in the "future executive" group, but there are too few employees in that classification to warrant a general rotation plan.

The positions of clerical employees within a department present a somewhat wider opportunity for rotation with good results. A careful job analysis should reveal comparable positions, the degree of training and experience necessary for satisfactory performance, and the logical lines of promotion. Clerks can be routed through an organized clerical training to a position suited to their capabilities, and in so doing a highly flexible and well-trained organization will have been developed.

There are many cases, of course, where the work is too specialized to permit an economic rotation. There are other circumstances where its value is questionable, such as in the case of young girls who will probably marry after two or three years' employment. In companies where there is little or no opportunity for "career jobs" for women, or where they cannot advance to supervisory positions, a plan of job rotation is not advisable. Also, in cases where the individual's capacity to advance is limited, the company is not justified in making the necessary investment in training.

Transfer of Employees

Because of prejudices and antiquated beliefs resulting from the lack of a scientific personnel transfer service, many companies have lost and are losing the constantly accruing benefits of transfers made to bring into closer harmony the employee's inclinations and adaptability, and his job. A company does not realize the full value of an employee who finds his job distasteful and disinteresting, and whose thoughts and inclinations are toward another field of the company's service. It is logical to believe, and experience has substantiated the belief, that the *mediocre* bookkeeper who wants to be a salesman will generally make a *good* salesman. It is also logical to believe that the employee who does his work well despite his distaste for it and his obvious talent for other work, will work happier and harder to definitely greater advantage at a job that conforms with his inclinations and talents.

It would be neither advisable nor possible, of course, to attempt to place every employee in the position he might prefer to his own. The preference of the employee and his adaptability are not always in harmony, and there will always be in any office those employees who are chronically dissatisfied with their work and who lack both the initiative and the ability to warrant transfer consideration to their benefit.

Function of the Personnel Department

In the development of a rotation and transfer policy, what should be the function of the Personnel Department? First, the Personnel Department should maintain an up-to-date job analysis and gradation program so that the relative complexity of clerical jobs is apparent and a fair value may be established for each job. The logical lines of promotion then become obvious. The Personnel Department should also maintain a "transfer index" listing all employees eligible for transfer or promotion.

Supervisors should have the right to recommend for transfer employees who do not make the grade but who could render satisfactory service in other jobs. A supervisor should not be compelled to carry "dead wood" and at the same time be expected to maintain high standards of efficiency. Likewise, employees should have the right to apply for transfer or promotion without jeopardizing their present jobs. They should have the right to make known their plans and ambitions for the future so that, if a suitable opportunity occurs, they may find promotion within the company. Situations are apt to arise where personality conflicts affect the quality of work. These can, as a rule, be remedied by transfer, and perfect freedom should be accorded the supervisor and employee to try to correct such unfortunate conditions through transfer to other environment.

As transfers are primarily a matter of selection, the Personnel Department is particularly qualified to cooperate with department heads. They may be especially helpful in situations involving changes to other types of work, by administering aptitude tests. Because of wider acquaintance among employees of all departments, the Personnel Department is frequently in a position to recommend the transfer of a better-qualified employee from outside the department in which the job exists, thereby finding the best-qualified employee available. It is natural for each department to think in terms of its own people rather than in terms of the whole company personnel. As a consequence an employee of special qualities and experience, able to make a greater contribution to the company through some other channel than his immediate job, may be overlooked. Unquestionably, it is advantageous to the company to place such a man where he can be most productive.

(Continued on page 459)

Contributed by the Office Management Committee, Wesley N. Geiter, Chairman.

Commercial Section

F. M. Banks, Chairman J. W. West, Jr., Secretary Hugh Cuthrell, Vice-Chairman

A Ten-Point Program for Greater Gas Sales

Charles E. Bennett

By CHARLES E. BENNETT

1936 Chairman, Commercial Section

STATISTICS for the first seven months of this year, as published by the Association, show quite conclusively that we have reached the turning point. Both the manufactured and natural gas companies show a decided increase in the number of customers. Residential sales, including house heating, likewise show an increase over the first seven months of 1935, and one particularly encouraging feature is that the domestic sales, exclusive of house heating, in the manufactured gas industry, are only 7/10 of 1% below the same period in 1935, whereas in 1935 these sales were 3 4/10% below 1934. Industrial and commercial sales for the entire industry in this same seven months' period show well over 20% increase with a revenue increase of 16%.

I realize that these increases are gross and may not all be reflected in net revenues; that there is a corresponding trend toward increased operating expenses which tends to absorb these increased revenues, nevertheless, there is much encouragement in the fact that there is marked evidence of improvement and greater sales.

Shifting into High

It has been a difficult job to take our business out of reverse and even hold it in neutral, but if we have now shifted into first (and from all indications this is so) it is up to every one of us to step on the accelerator and shift into second and high. We all know that it is easier to accelerate while in motion and that to stand still in business is to retreat. Now that we are going forward, why not profit by this advantage and place our industry in the position it so rightfully deserves?

Last year in accepting the Chairmanship of this Section, I stated that the commercial and sales activities of our industry were very much in the limelight and would be given more study and attention than ever before in the struggle for recovery. I also stated that for these reasons, the responsibilities of this Section would be greatly increased and that the trend of thought, being very definitely in the direction of sales, opened up new avenues of greater possibilities. I am of the same opinion today. I firmly believe that the door is open and it only remains for us to realize and assume these increased responsibilities in order to reach the goal of greater possibilities.

To accept these responsibilities and drive on with a determination that knows only success will require first and above all else a tremendous amount of hard work. A few of the highly important features that should be considered and incorporated in an intelligent and carefully planned offensive are—

First—A thorough knowledge of the sales problems and our customers' requirements.

Second—The cooperation of every employee both within and without the Sales Department.

Third—Proper rate revisions where necessary to establish satisfactory prices competitive with other fuels for each type of service.

Fourth—A constant effort toward better public relations.

Fifth—The development of adequate public acceptance of the value and economy of our service.

Sixth—A comprehensive and modern advertising program of sufficient magnitude to reach every customer and tell and retell the true story of gas service.

Seventh—The further development of dealer cooperation and a greater number of dealer outlets.

Eighth—Continued research in the fields of efficiency, improved design, and development of new appliances to meet the constantly increasing competition from other fuels.

Ninth—An industry-wide cooperative drive to so improve and promote the value and use of gas service as to definitely establish its leadership among domestic, commercial and industrial fuels.

Tenth—Executive recognition of the necessity at this time for a supreme sales effort, properly organized and adequately financed.

In my judgment, a fully rounded out sales procedure should include, among other things, the ten points just enumerated. They are not new ideas. The longer we live the more we realize the truth of the old adage that "there is nothing new under the sun." But there is value in repetition and the amplification of old ideas. All of you, at one time or another, have heard each of these points fully discussed, setting forth their importance and value.

I wish to stress at this time the desirability, yes—the necessity, for a coordinated procedure that will include all of these features.

The value of a thorough knowledge of our customers' requirements cannot be questioned. To know what the customer needs, what he wants, and what he will buy, is essential to develop fully all branches of our business. A customer survey and market research can and will supply the information needed to plan and develop effective new business procedure. If you have not made such a survey, the results of one might be very surprising and indicate the necessity of changing many of your present sales methods. The Central Hudson Gas and Electric Corporation is an outstanding pioneer in the use of customer surveys for the successful development of their load.

Employee Selling

The success that many companies have had with the plan of making "Every Employee a Salesman" is well known to all of us and needs very little comment here. There are a number of reports available, outlining the details of such a plan and the results accomplished. Those companies that have not derived the benefits from this cooperative feature can well afford to give it serious consideration.

Much stress has been laid in the past on the necessity for rate revisions and the adoption of so-called "promotional" rates. This is probably one of our most difficult problems in view of the present political and regulatory activities, but it is of such vital importance that there must be no let up in our efforts for better and more competitive rate design. Increased competition which now extends into our cooking and water heating fields can only be met in many instances with a revision in the design of rate structure.

The importance and necessity of a market survey to determine what our customers can really afford to pay for our service cannot be too strongly emphasized. This requires a study of our customers by classes, usually from the standpoint of income, and our rates must be so designed as to fit their pocketbooks and make it possible for them to utilize our service at

Chairman's Address delivered at annual convention, American Gas Association, Atlantic City, N. J., October 26-30, 1936.

costs that compare favorably with competitive fuels. In many instances, rate revisions of this kind require real courage. One of our major problems today is to hold our present business. We must recognize this fact, and if our rates are so designed, they will also encourage additional uses.

Better public relations and the development of adequate public acceptance of the value and economy of our service go hand in hand. If our customers are convinced that we are attempting to render the most satisfactory service at the lowest possible price, they will be our friends, and their friendship is probably the greatest asset a utility can have. However we cannot expect our customers to take this attitude unless they are assured they are getting value received for the service they purchase. I think a great deal has been done in the last few years to overcome what seemed to be a normal prejudice against the gas bill. We must keep constantly driving home the fact that gas service is one of the least expensive commodities on the market, using every means at our command to convince our customers of the truth of this fact. Only a constant and continuous reiteration of this thought will develop the public acceptance so much desired. Here again the cooperation and enthusiasm of every employee to sell this truth to his friends can be of inestimable value.

Advertising

This quite naturally brings us to the question of Advertising, which, I am happy to say, is being given more thought and attention by the industry than ever before. Money spent for and devoted to the advertising of our service seems extremely meagre when compared with the advertising expenditures of other industries and even our sister industry—the electric utility. If I recall the figures correctly, the amount is somewhat less than 50¢ per customer per year, and between ½ of 1% and 1% of our annual gross revenue.

From an advertising standpoint, our competition is not only from other fuels but we are in direct competition for the customer's dollar, particularly in the sale of our merchandise. I think it is a safe statement that the successful distribution of any commodity is impossible without advertising, and so long as advertising plays such an important part in the sales and disposition of equipment to the ultimate customer, we cannot hope to obtain our share of the business unless we properly advertise our service and merchandise.

It is my opinion that National Advertising has a very important place in any industry-wide program. The extent to which national advertising is employed (and it must be successful when you consider the tremendous amount of money spent for advertising each year in our national magazines) is sufficient evidence of its value. There is a definite relationship and tie-up between national advertising and local advertising. The greatest value from national advertising will result when the local advertising programs are designed to fit in with the national plan. The Committee on National Advertising has spent a great deal of time and hard work perfecting a program of value to our industry.

We need more dealer outlets to help us do this selling job, and I cannot lay too much stress on the desirability of more complete dealer cooperation. A rough estimate indicates that the gas industry has not more than one salesman for every three thousand customers. If we were to count the dealer outlets available to the electric industry, such as electric appliance dealers, the department stores, the five and ten cent stores, and many other merchants who sell electric appliances, it would be a conservative estimate that the electric industry has a salesman for every four hundred customers. The development of these dealer outlets has certainly been a paying investment. I know perfectly well that the number of dealer outlets available to the gas industry are not as many as those available to the electric industry, but certainly there are a great many dealers throughout the country who could be induced to sell our appliances and become enthusiastic boosters of our business. However—these dealers have to be sold, and they must be given an opportunity to make a profit on the merchandise they sell.

EFFECT OF GAS ON TREES

(Continued from page 443)

5. The trees in which the roots were exposed to 5 or 10 cu.ft. of gas in the soil exhibited no injurious effects the second season. Trees in soil gassed with 46.2 to 864.0 cu.ft. of gas exhibited signs of injury the second season. The injury consisted primarily of dried distal portions of some stems or branches. Below, the killed distal portions of stems or branches new, healthy, foliaged shoots developed. Very little definite injury to the roots of these gassed trees was observed in the second season.

6. It was not possible to assign limits for the volume of gas nor the period over which it must flow into the soil to produce definite degrees of injury or death.

7. From the similarity of these results to those obtained by using a "mixed" illuminating gas, and also ethylene and air mixtures enclosed about the roots of woody plants, it is suggested that ethylene or constituents of the coke oven gas with a physiological action similar to ethylene would explain the injuries, lethal, and stimulative effects upon these elm trees when roots were exposed to this coke oven gas in the soil.

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Industrial Gas Section

Ralph L. Manier, Chairman Eugene D. Milener, Secretary Hale A. Clark, Vice-Chairman

Engineering Improvements in Industrial Gas Apparatus and Their Economic Effect

By OLIVER LLOYD MADDUX

United Gas & Fuel Co. Ltd., Hamilton, Ontario

MANY of you were present at the first meeting of the Industrial Gas Section in Atlantic City in 1923. During the presentation of one of the papers a graphic description was given of twenty years' progress in starting a ventilating fan. That was thirteen years ago and if we attempted to make a comparable progress report on the development of industrial gas apparatus, the progress shown would be far more remarkable.

Then, we talked of wholesale baking, gas fired boilers, combustion, hotel and restaurant uses, house heating, progress in industrial appliances and how to get industrial gas business. We talked then of a thousand uses for gas that has since grown to ten times the thousand. We talked of aiming "to be in position to have equipment on the market that will do the heating work for every single operation known in industry today." Not even the man who spoke those words dreamed of how nearly that prophecy would be fulfilled during the thirteen years just passed. It is our purpose for the next few moments to look at some of these developments and as we do so to picture these developments as applying in our own cities and to think of those industrial operations wherein we will be enabled to obtain the goal we most desire, that industrial gas shall be the major division of our industry.

Convection Heating Growth

In the not too distant past we used to think of many of our low temperature operations as requiring a predetermined amount of heat depending on circulation of that heat to satisfy the requirements of the method or operation. What a vast difference there is between that type of heating and the application of convection and recirculation in these lower temperature operations. Within the last few years the adaption of convection heating has grown by leaps and bounds. Convection and recirculation have been applied to core baking, drawing, japanning, annealing of steel, aluminum, brass and other non-ferrous metals, at temperatures up to 1,400°; and there are many reasons why these operations can be more satisfactorily accomplished in this manner. Due to the constant intimate contact that the convection medium has at all times with the work to be heated, temperature distribution is more uniform and operating results entirely successful and economical. Applications of this method of heating have been made in both batch and continuous belt conveyor units. In the continuous type of unit the work is sometimes carried through on a belt, sometimes in baskets and in the case of small parts, springs, etc., packed to a depth of several inches.

Economic Effect

Here then is one of the recent developments, which is something new. Let us sum up its economic effect in industrial applications. Its radical departure from former methods, having a wide range of application commands the attention and vision of the prospect for industrial gas. It provides a real entering wedge for gas application, from the tool room to the main portions of the factory. It provides economy through the elimination of large quantities of refractory with attending high thermal heads and lastly, it is a vital piece of ammunition in our hands that will assist us in making gas the first-thought-of fuel in industry.

Another recent development in gas apparatus is the improvement that has been made in small oven furnaces. One manufacturer now constructs a small oven furnace firing top and bottom, venting from the bottom. This method of application insures heat distribution and better control of furnace atmosphere. Products of combustion must be discharged from the bottom vent and from the door when it is open. The chimney effect of the open door is entirely eliminated and with the proper mixtures on a one valve control set, both scaling and decarburization of the work is reduced to a minimum. Another new small oven furnace is the muffle type atmosphere furnace. These furnaces provide a uniformly heated working chamber within a muffle and have a special self contained apparatus for the preparation of furnace atmosphere. With this type of unit the best available atmosphere can be had to prevent those harmful effects that have been hard to eliminate in the past.

Ralph L. Manier, left, new chairman of the Industrial Gas Section, and Charles W. Gale, retiring chairman, on the boardwalk at Atlantic City during the A. G. A. convention

Atmospheric Burners

One of the newest developments in small tool room furnaces is that type of furnace equipped with atmospheric burners. These oven furnaces are lined with semi-, or insulating refractory brick and permit heating to 1,400° F. in 15 minutes' time; and in a little over an hour, a temperature of 2,000° F. can be reached. This application of atmospheric burners has also been made to high temperature pot furnaces for salts and metals where temperatures as high as 1,600° F. are required. This equipment requires no blower, is low in first cost and is ideally suited for installations where air under pressure is not available. Recently pot furnaces have been redesigned with top firing and bottom venting, which results in better efficiencies, longer pot life, more uniform heating, ease of control and more general satisfaction to the user.

Small continuous retort and conveyor furnaces for hardening, carburizing, nitriding and other heat treatments are still giving the satisfaction desired and are holding the place they deserve in tool room and production shops.

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The economic effect of these small furnaces is apparent; better working conditions in the furnace and in the shop; better work turned out of the furnace, more uniformly heated with less distortion and less cleaning and finishing. These provide additional new wide markets for industrial gas and what interests us most, increases the opportunities for gas sales and higher industrial revenues from our operations.

Another recent development in apparatus for the use of gas which will increase our market, is that of the high temperature, low pressure boiler. There are many operations in which a vapor is more satisfactory as the medium of heat exchange than any other known method. Saturated steam is an ideal method up to 350° F. (120 lbs. gauge) but above that point until recently there has been no universally satisfactory medium for this heat exchange. A recent development along this line is Dowtherm, a product which is an eutectic mixture of diphenyl and diphenyloxide. This material is a liquid at ordinary room temperatures and boils at 500° F. Its vapor at that temperature has 34.44 B.t.u's per cubic foot and is comparable with the latent heat of steam at a temperature of 212° F. of 36.24 B.t.u's per cubic foot. At 120 lbs. gauge pressure Dowtherm has a temperature of 735° F. and a latent heat of approximately 199 B.t.u's per cubic foot, with a total heat of 473 B.t.u. per lb.

There are many applications ideal for a Dowtherm boiler, among them are: Heating evaporators, vacuum pans, molding presses, oil stills and in processing oils and varnishes, melting tin and asphalt, in heating oil tempering tanks, drying ovens, dyes, lead cable sheath presses, etc.

These Dowtherm boilers are designed especially for the use of gas fuel and their operation can be controlled either by vapor pressure or vapor temperature. The announcement of these boilers has created in the minds of many of us numerous applications that were not heretofore possible for us to reach with gas and that is one of the primary considerations for beneficial economic effects. They are constructed in thirty-six sizes with a range from 15,000 to 2,250,000 output B.t.u's, indicating a wide adaptability where high temperatures and low pressures are desired.

Controls

Manufacturers of temperature and safety control equipment have made tremendous strides during the past few years with attending beneficial effects. There is still lacking the desired sentiveness of thermocouples but work along this line is now being undertaken by the Bureau of Standards and others. Control within very close limits can be had on temperatures up to 1000° F. with the use of sensitive bulb thermostats operating floating controls. On temperatures above 1000° F. thermocouples are used with diaphragm valves, proportioning motor valves and potentiometer type of controllers.

The greatest advance in recent years has been in safety control equipment. The thermocouple type of pilot control, more commonly known as the Baltimore Cut-off, has established an enviable record for positive action in actuating a gas valve and in breaking in an electric control circuit.

There is another type of thermocouple control in which the e.m.f. generated by the couple is transferred through a sensitive relay operating a main gas valve and through timing switches other safety circuits in sequence.

Another combustion safeguard is that one in which the flame is made a part of the electrical circuit. With this instrument as long as the flame is of sufficient length to touch the other pole of the instrument a small amount of electrical energy is carried through the circuit. This current may be passed through two types of relays, one to cut off the apparatus in case of pilot failure, the second to automatically relight the equipment should conditions return to normal. In the first case manual attention is required before re-ignition, while with the relighting unit flame failure causes immediate shut down but if within a predetermined time conditions of safety have returned combustion is restored by entirely automatic means. All of these instruments may be used in conjunction with other safety devices such as door, blower and sail switches.

Valves are now made of four different types, one of which may be diaphragm actuated, two others the induction and proportioning motor types, operating

National Hotel Show Features New Gas Equipment

HOTEL and restaurant owners learned how to make the sizzling steak of the diner's dream come true at the National Hotel Exposition held at Grand Central Palace, October 26 to 30. The newest radiant gas broiler was placed in operation beside the older type of direct-heat broiler to show the contrast in speed and fuel-saving, which has caused one hundred New York hotel and restaurant owners to install this modern gas broiler in their kitchens.

Demonstration of the advantages of equipping heavy duty gas broilers with ceramic radiants

The demonstration was featured in the display of gas-using hotel and restaurant appliances, shown jointly by the American Gas Association, Consolidated Edison Company of New York, American Stove Company, G. S. Blodgett Company, Inc., Detroit-Michigan Stove Company, Majestic Manufacturing Company, Robertshaw Thermostat Company and Standard Gas Equipment Corporation.

The exhibit at this year's show was one of the most complete and comprehensive displays of commercial gas-using equipment ever assembled. There were new features of gas ranges, deep-fat fryers, broilers, and toasters shown for the first time. Ranges and other kitchen units are so fitted together in any combination that no space for dirt and boiling over intervenes.

Gas ranges on display combined all of these features in one appliance—open and closed top burners, griddle, broiler, toaster and insulated and thermostatically controlled oven. This year's ranges are equipped with broilers using ceramic burners, which give off radiant heat. A four-slice automatic gas toaster was shown for the first time this year. The new deep-fat fryer is a great advance over its predecessors in speed and capacity in relation to size. Two fryers now fit into the space formerly occupied by one range. Gas water and house heating equipment formed part of the display.

either single valves, dual valves or ratio proportioning valves and the Solenoid type. A new type of magnetic globe valve is shown for the first time at this convention. In this valve the kinetic energy of the gas is used to operate the main valve seat. This energy is controlled by a small magnetically operated bleeder port. One peculiarity of this valve is the infinitesimal amount of auxiliary power required to control the flow of relatively large quantities of gas. The simplicity of these valves and the small amount of auxiliary power required enable them to be produced at a remarkably low unit cost for capacity.

Immersion Heating

For many years blast type immersion coils have been used in heating low temperature solutions. Within the past few years the application of blast type coils to heating of soft metals has reopened a market for us that had been threatened by resistance immersion elements. All of us are familiar with this application to linotype remelt and stereotype pots. This type of heating element has recently been applied to tinning pots and there are now many installations using gas, serving the tin plate industry. Many installations have been made recently applying atmospheric equipment to heating solutions and only recently this type of equipment has entered the higher temperature fields in melting and heating inorganic compounds and soft metals. Atmospheric immersion heating has a threefold economic effect.

1. Relatively low cost of installation.
2. High operating efficiency.
3. Wide range of application.

With the first effect, sales resistance is reduced to the lowest possible point, while the second effect creates general satisfaction in the use of gas as a heating medium. The third effect is that more of that volume business and higher bracket revenues result, the little matter about which we talked a moment ago.

Coils for immersion heating have been constructed of various materials such as brass, copper, boiler tubing, pipe, etc. for atmospheric burner equipment and of the alloys of iron and steel for blast equipment where higher temperatures are required in the material to be heated. Pipe coils are constructed by bending, welding and the use of pipe fittings and can be adapted to tanks of either wood or metal. The most recent applications of immersion heating have been with the use of lead coils internally fired in acid solutions in which it is impossible to use other materials. Only the surface of potential application in this field has been scratched and I commend it to you for increased industrial gas sales and revenue.

Research has brought to the gas industry what is probably its major development in recent years in industrial gas equipment, the Hot Tube Furnace. At its inception the broad possibilities of its application were little realized. Until this type of heating was developed muffles were required in the application of atmosphere control which were expensive both to install and maintain, thus leaving our business most vulnerable from that competition which did not require the application of muffles. Bright annealing of ferrous and non-ferrous metals called for atmospheres within the furnace under positive control. Clean hardening in the automotive industry became one of the specifications wherein machined surfaces could maintain close tolerances. Uniform control of case in carburizing and the cost of this operation in the production of gears, pinions, camshafts, etc. called for a positive application of controlled atmosphere.

A decided recent improvement in the art of gas carburizing has been made in which a continuous furnace has been constructed for this operation which maintains work entirely free from carbon soot deposit. In the steel industry hot tube heating is now the accepted standard in annealing coiled strip, tin plate and wire. Covers for annealing of strip and tin plate have been constructed to anneal, in one operation, as much as 100 tons of this material. Gradually the piling of this material under the cover has been increased to heights heretofore believed impossible.

Hot Tube Development

The recent application of hot tube heating in the ceramics industry has renewed the fervor with which gas has been accepted by that industry. The most recent furnaces so applied have in their application to porcelain enamelling, and decorating kilns, filled two places in which our industry met severest competition. Where hot tube heating is applicable the cost of fuel has never been the deciding factor in selecting the fuel to be used, but when energy advantage of *all* the methods available for controlling atmospheres and heating can be obtained with the use of gas in hot tube heating, then the cost of fuel may be a deciding factor, a factor that will enable us to hold this market 100% over that competitor which has encroached farthest into our field in advanced industrial heating. This method of application is equally adaptable to continuous, semi-continuous and batch type furnaces and is only limited in its application by the temperature the alloys of the tubes will withstand. Research is under way toward development of materials that will withstand temperatures higher than are now available. The field for the application of gas in industry will then be made unlimited.

It is impossible for me to draw a word picture that will show the full economic effect of hot tube heating and its wide and varied application in the industrial field. New uses for this type of heating are being constantly developed which will all result in the adaptability and the ac-

(Continued on next page

GOING AHEAD

WITH INDUSTRIAL GAS

Keep your eye on immersion gas heating for heating liquids in tanks. Its acceptance by industry is growing steadily and new applications are being worked out every month.

A booklet on "Deep Fat Frying Profits" published by Ahrens Publishing Co., New York, certainly shows how this method of commercial cooking is surging to the front. Get a copy and see just where gas is fitting into this picture.

Tuskegee Institute in Alabama has started a course that will turn out college-trained chefs. It won't take them long to discover that their art can best be practiced on gas ranges and the wide variety of other diversified gas commercial cooking appliances.

Tom Gallagher, representing the Industrial Gas Section, put his usual enthusiasm back of the gas exhibit at the National Restaurant Exposition in Chicago. The Section is grateful to you, Tom.

Believe it or not, the latest attraction for those who gather in front of show windows in the Broadway theatrical district is chicken being fried in gas deep fat fryers. Inside, the thousands of customers are invited to eat chicken in the old fashioned way. Hence the name "Bird-in-Hand."

Charlie Gale reports that in Knoxville as elsewhere industrial and commercial gas sales are on the up. The natives in T.V.A.'s headquarters city know a good fuel when they see it.

For the first time, a prominent hair dressing magazine has a special gas section. The November *American Hairdresser* with a streamer headline extending over the top of seven pages, impressively tells the story of how gas helps to beautify the American woman. The seven pages consist of a story furnished by the Industrial Gas Section, a review of up-to-date gas appliances, the advertisement of the Industrial Gas Section and the advertisements of the Butler Manufacturing Co., Emil J. Paida Co., The William Myer Co., and Hoffman Dryer Co., manufacturers of gas appliances.

ceptance of gas as the primary industrial fuel.

Being closely allied with hot tube heating, it is necessary for a moment to explain the various types of atmosphere control which can be had. One of these atmospheres is that which eliminates oxygen from the furnace atmosphere, freeing the work entirely from scale and eliminating surface decarburization. The apparatus for producing this gas is a converter in which the raw gas is partially burned in about 60% of the amount of air required for complete combustion of the gas being used. Either manufactured or natural gas can be successfully converted in this equipment. In the production of this gas no external heat is required since sufficient heat is generated during the partial combustion to completely reform the gas. A special refractory combustion chamber is used for this conversion. The converted gas is then reduced to cooling water temperature and may be further reduced with refrigerating equipment to completely remove the water vapor formed during partial combustion. Just enough combustibles are retained during conversion to neutralize the oxygen contained in the furnace atmosphere.

No method of heating a furnace in which a controlled atmosphere is required is possible without either a conversion unit as described or the use of more expensively prepared gases or with raw manufactured or natural gas. Thus, the inherent need of controlled atmospheres makes this type of heating dependent in whole or in part on industrial gas for an entirely satisfactory operation. Either manufactured or natural gas containing a high carbon content can be used as the atmosphere for gas carburizing and in some cases prepared gases are used in bright annealing the high nickel alloys, in nitriding, etc.

Industrial Air Conditioning

Much has been said and written with regard to air-conditioning in theatres, restaurants, office buildings and for industrial operations where control of temperature and humidity play an important part in the comfort of people and in production of materials. Gas is scheduled to play an ever growing part in this activity limited only by the aggressiveness of our industry.

Two kinds of apparatus have recently been placed at our disposal for use in this work, the gas dehumidifier, used to control the amount of moisture carried in suspension in the conditioned space and the gas engine driven compressor for a refrigerant to be used in the reduction of temperature. The former consists of an adsorbing material of a capacity to remove the amount of moisture required. This material is enclosed in compartments with such arrangements as are required for its regeneration by gas heat. Cooling of the dehumidified air may be accomplished either by the use of tap water if below 70° F. or by refrigerant should the tap water be too warm for the final temperature desired.

The gas engine driven compressor operates on either manufactured or natural gas and is fully automatic. This unit, quiet in operation, and low in operation and maintenance costs, is ideal for cooling in air conditioning work, for general refrigeration purposes and allied applications such as fur storage rooms, solution cooling either with immersed, expansion or Baudelet coils. In other words this unit or a multiple of them are entirely adaptable to all forms of existing air conditioning and refrigerating equipment.

Insulating Refractories

One of the most beneficial effects in its application to industrial gas equipment is the advance made in insulating refractories. This material being porous, and therefore light in weight, is ideally adaptable to gas fuel. They are of little benefit in the application of liquid fuel but assist materially the economic comparison between that type of fuel and gas. Likewise with resistance heating no material benefits accrue compared with gas in their use partly because insulation in large quantities has always been necessary with this type of heating and secondly because the use of these semi-refractories lies beyond the range of application of resistance heating.

Thus, for gas application, reduced weight in furnace equipment, faster heating time, lower fuel consumption per unit of production is the order of the day. With operating temperatures within the range of 3000° F., newer competitive situations are created for gas in the higher temperature scale. While these refractories cost a great deal more per thousand than standard firebrick the cost of a furnace constructed with them is not materially changed due to the lighter structural work and the ability to use thinner walls, still maintaining lower conductance and lower heat storage capacity.

In our natural gas districts there is one application of industrial gas which does not want to be overlooked, viz: the installation of gas engines as sources for power.

With natural gas selling at around 5 cents per therm, power can be generated at a cost of .63 cents per K.W.H. using a gas engine and generator. This cost includes lubricating oil, maintenance and attendance with the engine operating at 75% of its rated capacity. Should this engine operate at 150 hours use of demand monthly with an allowance of 10% of the investment cost for interest and depreciation, the cost of electric current so generated will be approximately 1 cent per K.W.H. Certain improvements have been made in the construction of gas engines in Germany with an engine that is readily convertible with an initial additional investment of approximately $2.00 per horsepower to a full Diesel engine. This has also been done in the United States. There is one particular economic advantage in this type of installation in that it permits the customer to buy power rather than take power. We believe the inherent possibilities of improvement of

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Gas in Forefront At Restaurant Show

By T. J. GALLAGHER

The Peoples Gas Light & Coke Co., Chicago, Ill.

T. J. Gallagher

ATTENDED by 9400 people, with 23 displays of modern gas commercial cooking appliances, with a centrally located headquarters' booth sponsored by the Industrial Gas Section, where visiting gas men and restaurant operators could get together, the National Restaurant Exposition was a successful promotional activity for commercial gas cooking. The exposition and the sessions of the National Restaurant Association were held October 19-23 in the immense Furniture Mart in Chicago, Illinois.

At the A. G. A. booth, gas company salesmen from The Peoples Gas Light & Coke Company and other gas companies, as well as salesmen from various equipment manufacturers, distributed circulars, answered questions and escorted visitors through the various gas appliance displays.

This was the eighteenth annual "show" of the National Restaurant Association and the attendance was greater than at any of those previously held. Restaurant, club, lunch room and tavern operators from all over the country attended. Every space in the large hall was filled and exhibitors of all commodities and equipment used in the restaurant field reported that they had booked business in excess of what they had expected.

The Industrial Gas Section has sponsored exhibits at the National Restaurant Exposition for several years, following the same practice in this field as it does in a number of others. These displays are arranged by the Committee on Displays at Industrial Expositions of which Karl Emmerling, The East Ohio Gas Company, was chairman during the Association year 1936. It is interesting to note that as compared with the 23 displays of modern gas commercial cooking appliances there were 9 exhibits of appliances that utilize other fuels. One gathered from the show that in the restaurant field, as in other industrial and commercial fields, "The Trend Today Is to Gas—The Modern Cooking Fuel."

Technical Section

M. I. Mix, Chairman H. W. Hartman, Secretary J. V. Postles, Vice-Chairman

What About Mains?

By ERICK LARSON

Long Island Lighting Co., New York, N. Y.

WHAT is known, what should be known regarding those physical forces which are vital factors in the design, construction and operation of sub-surface structures representing 60 to 90 per cent or even more of the total investment in each company. Out of sight, out of mind. This saying has unintentionally become a truth among many technical men in the industries having large investments in buried structures, thus saddling future generations with undesired, unnecessary inheritances.

Transmission and distribution engineers are responsible for the major portion of the tremendous investment in the gas industry. The operation and maintenance expenses of this buried investment are a factor in rates. Are engineers contented with the knowledge each possesses of the physical, chemical and electrical forces to which lines are subjected when out of sight?

A. G. A. Research

The American Gas Association, and other similar organizations, have spent vast sums in gathering field data and conducting research to determine the nature of the chemical and electrical forces causing corrosion and as a result of the knowledge gained, are able to prove or predict the real value of methods suggested for mitigating the tremendous destruction from corrosion. The contributions of Association members and the direct work of Dr. Scott Ewing, A. G. A. research associate at the Bureau of Standards, have been of vital importance in producing the present-day success in protecting pipe from the ravages of corrosion. The investigation of chemical and electrical forces has resulted in definite accomplishments and needs no further incentive to promote additional research than the success of the past.

With adequate protection why should we be interested in the physical forces surrounding buried pipe? Fundamentally to provide an equal capacity for less investment or greater capacity for an equal outlay and to secure decreased maintenance and operating costs.

An immediate question would be, is this economic result possible? The answer lies not in the practical developments attainable from a definite research program, but in the ability of the gas industry to visualize the possibilities, provide a concrete program and to adapt the new ideas emanating from the investigation. The assurance of tangible results lies in an analysis of past experience. Research is only necessary to establish certain minimum limits which safety demands.

One of the primary questions to be answered is, what structural strength is required in sub-surface structures? This may be clarified when an answer can be given to the question, what are the forces acting to require a resisting strength and what is the intensity of each?

The value of experience in indicating the total value of the forces has been frequently overestimated. The fact that not one force, or even one which may be considered as of most importance, but many are producing stresses in mains and that the occurrence of any one or a group in a particular locality is problematical, results in predictions from experience being practically impossible. An illustration may be the attributing to settlement of a trench the major blame for a failure, yet where are figures available to substantiate such a conclusion? Experience presumes an intimate knowledge secured from personal observations and study. It is feared that habits acquired through generations are sometimes misinterpreted as being experience. Again, a single experience may be overemphasized, and applied generally without sufficient basis.

Experience vs. Knowledge

An observation of all walks of life indicates that experience complicates and knowledge simplifies the problems presented for solution. Solutions of problems by those whose whole background is one of experience tend to add to an existing structure more complications to overcome a single difficulty. Knowledge analyzes all factors surrounding a difficulty and by a perspective of the whole seeks to determine the fundamental cause of a weakness rather than a mere cure. Note the simplicity of design in modern mechanical joints yet the effectiveness with which they provide against numerous potential difficulties.

Analyze the installations whose design and construction are based entirely on experience and notice the frequency of contrasting and conflicting opinions and results. For instance, in the early days of screw joints—breakage in the threads was a common occurrence. A gentleman in Providence, R. I., having little for his machine shop to do in the difficult economic time following the Civil War, conceived the idea of a recessed coupling, although he was entirely lacking in pipe line experience. Its value in improving the tightness of a joint was apparently a minor consideration compared with the merchandising vision which originated the idea that a recessed coupling would protect the joint and minimize breakage. In the light of present-day engineering knowledge, we wonder at the widespread adoption of the device without substantiation of the statement. Yet the recessed coupling continues in popularity even today, based on an unsupported premise.

Temperature Variations

Many years past, imagination, father of all conception, made further pipe line progress by attributing to expansion and contraction the major portion of all breakage. Manufacturers properly capitalized on this idea. It remained for cast iron pipe manufactures in recent years to indicate by mathematics and experimentation on actual lines the real status of temperature in the structural strength requirements of buried pipe. This commendable effort served its purpose, but do we still fully possess the required knowledge on temperature variations? What is the mathematical relationship between soil temperatures and the strains imposed upon a buried pipe line?

A comparative recent and decidedly progressive advancement in main design was welding and brazing. Here again is an indication of the economic value of research. The early joints did not develop full strength of the pipe itself and breakage occurred in the welded joints. Considerable investigation produced data showing the relationship between the actual strength of a welded joint and the parent pipe metal. Where chemistry and physics could not immediately produce direct causes for the differences, research was resorted to and in a comparatively few years the art of welding had advanced to the point where only a practical procedure control was necessary to produce a one hundred per cent efficient joint. Progress was not allowed to cease and continued study has increased speed and lowered costs. The development of welding and brazing has focussed attention on many causes of strains and determined the resulting intensity of stress.

The almost total absence of breaks in modern solidly welded cast iron or steel systems and also the fact that the few breaks occurring are in the joint, have ap-

parently failed to indicate to the industry at large that more metal is being buried than structual strength or any other factors require. A cut and try method of determining the wall thicknesses actually required would be a slow, opinionated and on the whole an unsatisfactory approach considering the engineering and scientific ability available in the industry.

The study of welding, together with another important advancement in pipe progress, the development of centrifugally cast iron pipe, both working independently, have made an important contribution by indicating the value of flexibility in structural requirements.

The Technical Section of the American Gas Association has contributed valuable data to the general knowledge of how forces may act upon pipe lines through development of standards for bell clamps and mechanical joints. During the progress of this work, extensive and intensive laboratory tests were conducted by the A. G. A. Cleveland Laboratory. Considerable knowledge regarding resistance of pipe to strains was accumulated during the joint standardization especially in the second step of three essential research phases; theoretical study, laboratory investigation and field experience.

It is believed history was made in this particular undertaking as it is doubtful whether thorough search of the technical progress in the gas industry will reveal many instances where progress from origination of the idea, through realization of the value, selection of personnel, detailed outlining of each phase, transforming of theory into tangible application by the staff of the A. G. A. Cleveland Laboratory to the many practical efficient joints developed by manufacturers occurred in the span of so few years. Here was a research which required daring to instigate, considering the deeply embedded joint habits then in existence. But, not only did the gas industry materially benefit by the direct results of this investigation of pipe joints, but the indirect results are many, not the least of which was the development of a liquid for the mitigation of leakage in cast iron bell and spigot joints, the conceiver of which was awarded the Beal Medal for original research at the 1936 Annual Convention. This latter development did not materialize from practice to theory, but is an excellent example of the intrinsic value of research.

Solutions of the widely varying problems presented by the conditions represented in these two illustrations require intensive and extensive knowledge of natural phenomena

Problems for Solution

The question may well be asked, has not investigation in the many phases of structural design been sufficient to provide all the desired information? This question may well be met by another, the answer to which will indicate to each individual the additional study required. What about vibration, ground movements in every plane, the effects of the gripping action of soil not only when the ground is frozen, but at all times? Has the penetration of frost a bearing on variations in strains? Is mathematics sufficiently developed to provide a workable basis from which to determine the resultant force when the individual strains may occur in all three dimensions as well as torsionally simultaneously? Are conceptions of stresses in structures sufficiently clear to recognize where concentrations are the primary cause of failure rather than uniformity of forces? What one or few simple observations will provide an accurate value of the resultant stress? Why do not all companies bury mains with only a foot or two of cover when a few in all climates have done so successfully?

We place in the ground and link with other systems more complicated structures than any erected from the ground surface skyward, and should conscientiously ask ourselves, have we the adequacy of basic knowledge necessary to provide the economy which the stewardship of millions of dollars warrants, and yet supply a sufficiency of safety, the moral obligation of which is worthy of consideration?

Tangibly, what can we hope to obtain through more intimate knowledge of all factors involved? Increased safety from the

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Testing Laboratories

R. M. Conner, Director — Managing Committee: J. S. DeHart, Jr., Chairman — N. T. Sellman, Secretary

Applying the Industry's System of Self-Regulation

An A. G. A. Laboratories engineer making an inspection in a water heater plant. Right—Inspecting heater jackets in the racks of the storerooms.

THESE photographs, taken in the Cleveland plant of a well-known water heater manufacturing company, show how appliances bearing the Laboratories' Approval Seal are checked for maintenance of proper standards.

Experienced engineers visit every concern making certified gas-burning equipment at least once a year, and check every detail of all appliances bearing the Laboratory Seal of Approval. Any discrepancies between these production models and drawings, made by technicians at the A. G. A. Laboratories, of the actual test model are immediately called to the attention of the manufacturer and alterations made or retests conducted before extension of approval is granted. In practically all cases, however, production models are found to be identical with those tested.

Occasional inspections of the gas appliances in the stock rooms of gas companies and other dealers serve as double-checks on appliances being marketed bearing the Approval Seal.

Below—These visitors from the Third World Power Conference praised the rigid safety requirements as they viewed a range undergoing the fire hazard test. Left to right, H. R. Cook, F. O. Suffron, Thomas Hardie, England, Dr. Ing. C. I. Motas, Roumania, G. P. Bender, E. G. Fottrell, England, R. W. Hunter, England

Above—Much interest was shown by this group of World Power delegates in the precision gas analysis equipment developed at the Laboratories for use in research on reducing atmospheres in industrial gas furnaces. Left to right, E. O. Mattocks (partially hidden), H. C. Porter, Arthur Pfeiffer, Germany, Richard Fenner, Chili, Dr. Ing. Spackeler, Germany, and Dr. Willie Schmelcher, Germany

Meeting of Subcommittee on Approval Requirements for Central Heating Gas Appliances at Cleveland Laboratory October 22. In the picture are, left to right: Major W. E. Stark, Bryant Heater Co.; G. H. Irwin; R. M. Conner, A. G. A. Testing Laboratories; E. A. Jones, L. J. Mueller Furnace Co.; F. M. Banks, Southern Calif. Gas Co.; H. B. Johns (chairman), The Peoples Gas Light and Coke Co.; Thomson King, Consolidated Gas Electric Light & Power Co. of Baltimore; E. W. Esslinger, Cincinnati Gas & Electric Co.; K. R. Knapp, A. G. A. Testing Laboratories; R. H. Taylor, Public Service Co. of Colorado; S. F. Jaros, A. G. A. Testing Laboratories; and C. F. Turner, The East Ohio Gas Company

Gas Men Participate In Patent Event

MANY of the nation's leaders in applied science, art and industry gathered at Washington, D. C. November 23 for the Centennial Celebration of the American Patent System and reviewed 100 years of progress as reflected by the inventive genius of the country.

Among those who served on the national committee of 47 members made up of the nation's leaders, who were in charge of the celebration, were two men prominent in the gas industry. They are: Dana D. Barnum, president of the Boston Consolidated Gas Company and president of the American Standards Association, and Arno C. Fieldner, chief engineer of the experiments station of the U. S. Bureau of Mines.

Laboratories' Employee Dies

ON October 22, Neil Meighan, an employee of the American Gas Association Testing Laboratories for many years, died at his home in Cleveland, Ohio.

Mr. Meighan was well known to the appliance designers and manufacturers who visit the Testing Laboratories. He is survived by his wife, Mrs. Janet Maitland Meighan, and an eight-year old daughter, Kathleen, both of Cleveland; also his mother, two sisters and a brother, all in Scotland.

Born at Milingavie, Scotland in 1904, Mr. Meighan was educated in the public schools there. He lived in Cleveland from the time of his arrival in this country in 1926. After working for the Chandler Motor Company, he was employed in the construction of office buildings. In 1930, Mr. Meighan joined the Maintenance Department of the Association's Laboratories in Cleveland, and was connected with that division until his death.

Largest Appliance Directory Issued

IN October, the Testing Laboratories presented the quarterly "Directory of Approved Gas Appliances and Listed Accessories." This booklet of 113 pages is the largest ever published. It lists 106 concerns producing water heaters for use with city gas, 99 engaged in manufacturing central heating appliances, 75 firms making gas space heaters and 72 range manufacturers in addition to a host of producers of accessories and other types of domestic gas-burning equipment.

The increase in the size of the register is due more to the introduction of new models than to entrance in the gas appliance field by other interests. It undoubtedly reflects distinctly improved selling conditions within the gas industry.

In addition to the complete directory which is published four times a year, monthly supplements are printed to keep the list up-to-date. The "Directory of Approved Gas Appliances and Listed Accessories" may be obtained from the American Gas Association Testing Laboratories, 1032 East 62nd Street, Cleveland, Ohio. The prices are 35 cents per copy for the quarterly issue, 10 cents for each monthly supplement, and $2.00 a year for a subscription which includes all directories and supplements.

IMPROVEMENTS IN INDUSTRIAL GAS APPARATUS

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gas engines are great, as would naturally be the case where over-all operating efficiencies due to thermal and cooling water losses, are as low as now obtain. We commend to the manufacturers of this type of engine the thought of supercharging to enable a higher B.t.u. input per cubic inch of displacement which should result in much more compact designs and lower thermal losses.

We believe we have pointed out some of the major improvements in industrial gas apparatus and some of the economic effects of these improvements. Stress was

not laid on the economic effect while reviewing these developments for the reason that this effect is essentially the same for each development and improvement that has been made. But first let us consider what the fundamentals of economics are that we may better determine the accruing benefits in the application of gas industrially. Basic economics may be summed up in two fundamental forms, first the right of man to live, second, that there be available for him those things required in that living. The first of these fundamentals requires that he have food, shelter, clothing and comfort. All of these things come to him only by an economy of plenty, for only in this manner can prices prevail within the range of his purchasing power. Gas contributes to these basic requirements in a material way, that is it assists in producing goods in quantities and frequently at a lower cost, quantities sufficient for all and costs within reach of all. Any other matters of economics are details which can be segregated into one of these two fundamental principles. We say that gas contributes to this economic picture, that it has material benefits to humanity. Just what is this effect and how does it accomplish this primary purpose? I submit for your consideration these effects:

1. Better heating methods insuring more uniform production.

2. New applications of heat transfer resulting in new ideas of heating that awake vision, favor and acceptance on the part of the user of heat in industry.

3. Control equipment development giving a flexibility and safety to gas operation more favorable than with any other fuel.

4. Quicker heating-up time eliminating uneconomic delays and costs in plant operation.

5. Lower operating costs per unit of production.

6. Absolute control of quality of work with precision in the control of atmospheres.

7. Establishment of a new threshold for the activity of industrial gas operations.

The first six of these seven points are self evident facts within the scope of our knowledge of industrial gas application; the last is worthy of a moment's consideration.

Economically there are three vital factors involved in the acceptance by industry of gas as an industrial fuel. They are:

1. The equipment to do the work.

2. Costs that show high production and other benefits as compared with other fuels.

3. The market for the fuel.

When we emerged from the depression of 1920-1921, gas as an industrial fuel was just being pioneered. The equipment necessary to do this work was crude and imperfect, yet withal great strides were made by those on whom the responsibility rested. The comparable costs and production results were not as beneficial as they are today in the operation of equipment using our fuel. The market for industrial gas is steadily growing along with the desire for an ever rising standard of living, a continued development of new uses for fuel and a constant improvement in the design and application of gas to heating operations. We have all three of these factors before us today. The development in equipment has been far in advance of our past ability to saturate our market. In other words, we have a lot of catching up to do with equipment already at our disposal and I believe that each of us as individuals have failed to realize the vastness of our unsold market. This sale of industrial gas is our responsibility in which we have been given a heritage of pioneering and progress. The future of gas in industry rests individually and collectively in our hands.

Second, what particular lines of investigation are most vitally necessary? Every phase of an industry has its particular necessities. The peculiar situation of the gas industry in regard to research requires real study of the particular problem or problems in each phase to determine which warrant the co-ordinated efforts that can be furnished by an Association, such as the American Gas Association. The situation should also be an inspiration for technical departments' executives to encourage those with the gift of vision to set forth their ideas.

This particular article is an expression of opinion written primarily to secure the ideas of others, in order to pass on to those in whose hands rest ultimate decision a broad yet definite picture. Only one more question. What do you think about the subject?

WHAT ABOUT MAINS?

(Continued from page 456)

hazards of explosions and asphyxiations, both of which indirectly affect public relations; decreased leakage producing less unaccounted-for gas; a decrease in the investment per customer; lower maintenance and repair costs; longer structural life and the many indirect savings resulting from all, not the least of which is to contribute the engineer's share toward continuance of earnings and make possible decreased rates.

There appears that familiar refrain, "What will it cost?" Who knows? As the realms of natural phenomena are delved into by the conscientious seeker of knowledge, there are revealed treasures in ever-increasing abundance. In the world the very term "United States" signifies the highest plane of living for rich and poor alike, brought about only by continuous progress in adapting the laws of nature to daily convenience and necessity. Prediction of results or cost is futile. The question rather is, can we afford to go on without this particular and many other important investigations? For a time any industry may live on the plenty stored in the past, but continuous life requires progress which in turn demands more extensive and intensive knowledge.

The question is two-fold. First, what can we spend in the immediate future on the seeking of fundamental physical knowledge? A difficult question for the executive under the stress of present day circumstances. Vision and foresight alone must dictate, as there can be no prediction as to when the budget can be balanced by the resultant savings and to what extent the knowledge obtained can be applied. However, the gas industry has had many recent instances of outstanding executives pleading the cause of research, and the much needed funds will undoubtedly be forthcoming. The threats of the competitors of today will not be allowed to materialize in the future because of a lack of funds to provide the economic necessities of the morrow. The tangible accomplishments already outlined, together with many others, will influence judgment.

ROTATION OF EMPLOYEES

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Lest he jeopardize his future, an employee sometimes hesitates to say he prefers not to accept a proffered transfer. He will, however, be more apt to confide in a third party. By giving the employee an opportunity to discuss the proposed change with the Personnel Department, a freer choice is made and better selection effected. We recall the case of a young woman promoted from a clerical to a telephone position where her work was only mediocre. In talking casually to a member of the Personnel Department, she revealed the fact that the telephone instrument hurt her ears and caused difficulty in hearing. She said also that she had always had an inexplicable fear of telephoning which made her nervous about the work. Although her supervisor was a very approachable person genuinely interested in his workers, the girl had not told him any of these circumstances because she feared no other job would be available if she refused the transfer offered. Her family was in need of the money she earned, and she felt she could not afford unemployment. Fortunately the situation was cleared up by a further transfer which returned her to clerical duties. If transfers were normally a "three-way affair" involving the department head, the employee, and the Personnel Department, such incidents would be less likely to happen.

A well-thought-out rotation and transfer policy should be a part of every sound personnel program for it has a definite relation to training, salary and wage gradation, non-financial incentives, labor turnover, and the future administration of the company.

Personnel Service

SERVICES OFFERED

General **Superintendent** or Local **Manager.** Fifteen years' experience in the production of water gas, coal gas, and Pacific Coast oil gas, high and low pressure distribution and transmission, domestic and industrial installation and utilization. Mechanical engineering education; speaks English and Spanish, employed at present. (37). **1040.**

Service manager, 13 years' natural gas experience, transmission, distribution as construction and maintenance foreman. Domestic, commercial and industrial selling, aiding salesmen to close, advising in heating problems, laying out new systems, renovating and modernizing old systems; specialist in heating, employed. (31). **1041.**

Meter shop superintendent, 9 years' experience in gas meter repairs in charge of meter shops repairing 60,000 meters per year. Thoroughly familiar with modern meter work and manufacture of meter diaphragms. University graduate. Good personality; can effect economies. **1043.**

Manager 24 years' experience in all branches of manufactured coal and water gas. Built and operated plants for sixteen years; with last organization seventeen years every capacity, last eight years as manager property 5,800 meters, showing exceptional results. Have endorsement of city officials and leading business men with fine public relations; married. (44). **1045.**

Sales engineer or supervisor (38) with ten years' experience in the gas industry covering everything in the industrial, domestic, housheating, commercial, hotel restaurant and refrigeration lines, desires identification with public utility or manufacturer. **1050.**

Engineer experienced (16 years) in the construction of water and coal gas plants and apparatus, including several years supervising installation and repair wet and dry holders, with largest gas plant company in U. S., last four years on valuation work. **1051.**

Twelve years' gas utility experience as superintendent of distribution, service and **sales.** Have produced results at low unit cost. Employed last three years in personnel work; not afraid of hard work or responsibility. Married, good health; (36). **1052.**

Man who is willing to begin as a subordinate with gas utility wants position; experience covers manufactured gas, natural gas, and distribution, also public relations. Have worked from the ditch to **superintendent,** have laid out and built gas plant. **1055.**

Topographical draftsman—Experienced in the detail platting and recording of oil and gas field operations, and presenting all such data in graphic form. Also a substantial background in statistical, preparatory surveys, layout and printing proposals. **1056.**

Engineer with 29 years' service with utility company. Familiar with all branches of gas construction specializing in report, estimates, construction and appraisals, also studies relating to assessments and revision of taxes; also electric experience. **1057.**

Advertising—publicity. Six years' newspaper reporter. Four years' advertising and editorial work among both manufactured and natural gas companies, in different sections provide broad knowledge of appliance selling and public relations on rates, franchises, etc. Copywriter, rough layouts and able to handle production detail; graduate. **1059.**

Sales promotion—advertising—publicity. Do you believe sound ideas sell goods; that dramatic layouts compel attention; that convincing copy gets inquiries? Then I have what you want. Let me show you a campaign that doubled factory's production. Four years with leading utility. Know advertising production, printing, engraving, etc. **1061.**

Advertising man with usually successful record in **advertising** and **sales** promotion, backed by actual sales experience. Capable of taking entire charge of advertising operation, or can render invaluable service as assistant to busy commercial manager. **1062.**

Recently graduated gas engineer desires to become connected with a gas company in a **technical** position. Willing to work and cooperate with my fellow workers. **1063.**

SERVICES OFFERED

Director of Research—nineteen years' experience; eight in high and low temperature coal-tar, oil cracking and refining; eleven in space and **house heating.** Outstanding research in heating, conversion and gas designed; also in air conditioning. Desire connection with manufacturer who would like to step out ahead of the rest. **1064.**

Position desired with gas company as **house heating salesman.** Twelve years with large eastern gas company. Selling, surveying and supervision. A-1 record. **1065.**

Heating, cooking appliance **salesman** desires connection with manufacturer. Twenty years' experience selling wholesale and retail trade, and utility companies, in eastern and southern territories. Have ability to organize, create a volume of business and handle any territory to mutual advantage. Have no preference as to territory. **1066.**

Technical graduate desires new connection; six years' experience in plant construction, operation, distribution and appliance servicing; five years' experience in industrial, commercial and heating **sales** with natural and manufactured gas; completed Columbia University extension course in "Manufactured Gas"; married; (33). **1067.**

Young man, good appearance, education and refinement, with full share of health, energy and judgment based on 2½ years' practical pioneering **air-conditioning** experience promoting manufacturer's equipment; (33). **1068.**

Gas **technologist engineer** with 12 years' experience in natural and manufactured gas industry as manufacturing and distribution engineer operator and designer of equipment, surveyor and expert in map work. **1069.**

Sales Promotion. Past five years with nationally known manufacturer as field representative in sales promotion department. Utility, dealer and consumer group meetings effectively conducted. Educational work and personal sales calls with salesmen; preparation of sales promotion literature. Acquainted with utilities in New England, New York, New Jersey, Pennsylvania. **1070.**

Inventory-appraisal **engineer** with 20 years' operating, sales and construction experience, offers services in any capacity in the gas business. Experience covers both natural and manufactured gas; go anywhere (39). **1071.**

Mechanical engineer, university graduate; 8 years' experience in manufactured gas; transmission, distribution, construction, operation, maintenance, design, planning, testing, reports, studies, budgets, rates and management. Held positions as chief draftsman, cadet engineer, service manager and assistant engineer. Interested in research and air conditioning. Desires position as **engineer** or **manager.** Married. (29). **1072.**

Graduate **engineer,** sales and technical experience. At present with large gas utility company selling house heating equipment and other gas appliances. Broad engineering experience with electric and steam power companies. Also purchasing experience for large industrial organizations. **1074.**

Gas engineer nineteen years' designing, manufacturing, erecting and operating producers, blue and carburetted water gas plants. Experienced with all kinds fuels; five years in Russia. Not particular, anything from foreman to chief engineer large plant or group small gas properties. Best references. **1075.**

Salesman in Metropolitan area New York and nearby States seeks position to represent manufacturer in gas appliances, gas fired boilers, gas ranges, water heaters all types and refrigerators. Has an established trade for last fifteen years among gas companies, wholesalers, distributors and plumbers and dealers, architects, builders. **1076.**

Thoroughly experienced **sales engineer** in industrial gas and gas house heating, services available at once, twelve years' experience in gas utility new business operations. **1077.**

SERVICES OFFERED

Utilization and **sales engineer.** Long experience in househeating, industrial applications and restaurant equipment. Can make complete investigation and survey and select proper equipment; can direct correct installation. Thorough in inspection and maintenance of appliances. Can manage a department for a utility. Will represent a manufacturer in the New York Metropolitan area. **1078.**

Salesman, good education and training wants connection in sales department. Can make house heating surveys and sales. Eleven years in the gas industry. In good health and will go anywhere (35). **1079.**

Graduate mechanical **engineer**—Broad technical experience in the gas industry, including both manufactured and natural gas—sales, production, utilization, distribution, construction, rate making, appraisals and reports. Available on short notice. **1080.**

Can you use any of these: Ability to get and hold dealer cooperation, general **sales-promotional** and public relations or advertising service, singly or in combination, all ripened by broad business experience and supported by impressive proof? Available without delusions of grandeur as to compensation. **1082.**

Consultant, long experience as manager, cosmopolitan cities, desires temporary engagements to investigate, criticize or cooperate in the **handling** of **customer accounts,** dealings with customers, personnel, accident compensation, negligence claims. Anything pertaining to the business or customer side of the gas industry. Any city, any time, long or short periods. **1083.**

Sales and **promotion** of appliances for househeating, domestic and small power and industrial installations. Previous utility experience includes supervising and operating mixed gas systems, natural gas changeover, distribution and utilization. **1084.**

Twenty years of experience in executive capacity in **utility management,** including electrical contracting and merchandising of fixtures, electrical ranges and refrigerating machines; in last eight years' management of forty-three million dollar company, gross earnings increased four and one-half and net earnings ten and one-fourth times. **1085.**

Services of able and energetic man offered as **representative** in New York holding corporation utility fields: proposed work to cover **sales promotion** and presentation of products to utility headquarters and passing back reaction of reception along with suggestions to factory executive. Interview requested with substantial manufacturer. **1086.**

Sales representative for range manufacturer in any Eastern territory; aggressive and capable, college graduate; successful managerial experience on propane bottled gas with company which has enjoyed exceptional growth in territory served. (32). **1087.**

Gas sales engineer. College graduate, experienced in marketing natural gas to institutions for heating; oil refineries, glass and paint companies; ceramic, ice and power plants, salt companies and heat treating plants. Familiar with design and installation of metering, regulating and burning equipment. Now employed. **1088.**

Sales engineer. Househeating, water heating and industrial application. Supervisory capacity. Experience covers surveys, sales, maintenance, sales promotion, reports, installation, service and repairs. Broad general and technical knowledge and excellent public relations. Married. **1089.**

Young man, university graduate 1936, B.S. in Economics, public affairs major; interested in public relations work. Desires to become associated with gas or electric company, willing to learn business and start as a **cadet.** Good worker, references. **1090.**

Appraisal engineer, four years appraisal experience on gas and electric utilities and background of more than twenty-five years' actual management, operation and construction of manufactured and natural gas utilities. Have made rate studies, written reports and very familiar with public utility accounting. Available immediately. **1091.**

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